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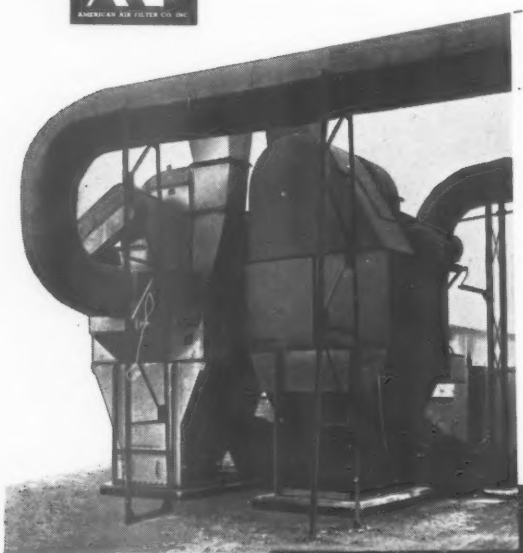

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# What the Foundry Foreman is Thinking

The eighth Foremen's Training Course, organized by the Institute of British Foundrymen and recently held at the Hotel Majestic, Harrogate, differed from the first most markedly in the improved general calibre of the participants. The muffler, in evidence in 1948, has been completely replaced by the white collar—as indeed it should. Attendance at these annual gatherings shows no signs of reduction, whilst on the other hand, enthusiasm is mounting. The support lent to these conferences by the president, vice- and past-presidents of the Institute is of material value. Discussions were of a high standard and indicated that the British foundry foreman has assimilated, in a very high degree, the technology requisite for the carrying out of his complex duties. This was especially noticeable during the discussion on an address by Mr. Talbot, on the $CO_2$ Process.

The foremen are a little worried by the status nowadays accorded to them. One of the bugbears in the larger concerns—and this extends to the foundry managers too—is the advent of the personnel manager. This official, we gathered, often controls the selection not only of new labour, skilled and unskilled, but also of the apprentice. One manager, with a proud record of outstanding successes, complains that since the introduction of the personnel manager, a lamentable decline in interest on the part of the boys has been noticed and but few stay in the foundry. The remedy, to our mind, is to reverse the procedure by allowing the manager or foreman to make the first contact with his boys and then report to the personnel manager the decision taken, for confirmation One real "grouse" was expressed by Mr. Haynes, that one of his brighter boys after receiving tuition in the craft of moulding and making good progress for several years was called up for military service, but instead of doing this, was found to be working in a nearby coal pit. This waste of time and effort in learning two trades of equal national importance is obviously against the public good.

The boards of directors of the foundry industry must before anything else do everything within their power to enhance the status of their foremen for only by so doing can they ensure that the policies they evolve round their table are carried out. They must lend their full support to aiding him in his difficult tasks of creating harmony in the shop, increasing production and developing new techniques. If the best principles of human relationships exist between the highest executives and the foremen, then there will be little worry as to the creation of the team-spirit on the shop floor. Leaving these functions of human relations to one individual is not invariably the best solution, though there are a number of cases where it does work successfully.

# Correspondence

## HARD SPOTS IN MANGANESE-BRONZE

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—As you will be aware, the technical committee of this Association has for some time been investigating the phenomena of hard spots in manganese-bronze. Good progress has been made with the investigations, but to enable further progress to be made with the analysis of the hard constituents, a considerable number of samples is required.

We would request the assistance of your readers in this matter by inviting them to forward to us samples of metal containing such hard spots. Any help in this way which may be afforded would be very much appreciated and, we hope, of benefit to the founders in attaining the elimination of such troubles.

HEATHCOTE & COLEMAN,
*Secretaries.*

British Bronze & Brass Ingot
Manufacturers' Association,
69, Harborne Road,
Edgbaston, Birmingham, 15.
April 6, 1956.

## National Foundry College "Open Day"

The National Foundry College has arranged an "Open Day" to be held on May 31. The proceedings will commence at 2.30 p.m. with the distribution of National Foundry College diplomas for the years 1953-4-5 by Sir Frederick Scopes, chairman of the Governors. After this ceremony the various rooms and laboratories of the College will be open for inspection. Special demonstrations have been arranged and will include shell moulding and the $CO_2$ Process relating to moulds and cores. An exhibition of s.-g. iron casting will also be on view. Owing to the limited accommodation admission will be by ticket only, which may be obtained from the clerk to the Governors, National Foundry College, Stafford Street, Wolverhampton.

## Light Metals Congress

The third International Light Metals congress is to be held at Leoben, Austria, from June 7 to 9. Papers from the UK are being presented by Mr. W. J. Thomas, joint managing director of the British Aluminium Company, Limited, who speaks on the place of light metals in British engineering; by Major C. J. P. Ball, president of the Institute of Metals and chairman of Magnesium Elektron, Limited, who speaks on the present position of magnesium technology; by Mr. W. G. Richards and Dr. C. Wilson of High Duty Alloys, Limited, whose subject is the forging and pressing of light alloys; and by Mr. R. D. Hamer, vice-president, Aluminium Laboratories, Limited, who is lecturing on the continuous casting and rolling of aluminium ingots. Details of the congress can be had from Mr. J. H. Fearon, Information Department, Aluminium Laboratories, Limited, Banbury, Oxon.

## Index to Vol. 99

The index to the JOURNAL, volume 99, covering the period July to December, 1955, has now been printed and is available to readers free of charge. Applications for copies should be addressed to the publishing office, FOUNDRY TRADE JOURNAL, John Adam House, John Adam Street, Adelphi, London, W.C.2. Subscribers who wish to receive copies of indices automatically as they are printed may apply for inclusion on the permanent mailing list. Those already on this list need not apply for their current copy.

## Industrial Art Exhibition

It is of importance that a great industrial establishment—Richard Thomas & Baldwins, Limited, has made such a magnificent gesture as to place £1,500 for the creation of prizes to artists making pictures of any type of manufacturing activities. An exhibition is now being held at the Chenil Galleries, Chelsea, which shows a wide selection of the pictures submitted. The first prize was gained by a picture of the mechanized foundry installed in the works of the East Sussex Engineering Company, Limited, at Lewes. The artist is Mr. F. J. Yates, a teacher in the local art school.

The general impression of the exhibition is that modern artists are not too good at reproducing human figures; one artist has introduced a quantity of spindle-legged monstrosities. He could with equal effect have used "pin" men. Then some used colour of too dark a hue for the industrial scene, while others resorted to colours so garish as to make them resemble picture post-cards from Cairo. Many pictures, however, were well-suited for hanging in the board or waiting rooms of large works. Perhaps the most successful efforts were by those artists who followed the Canaletto school. The exhibition is to go on tour to the large cities and it is certainly well worth a visit.

## Death of Mr. Henry Bunting

The death is announced of Mr. Henry Bunting, formerly works manager of the Rutland Foundry Company, Limited, Ilkeston, Derbyshire. Harry, as he was universally known, was for 40 years very prominent in foundry technical circles. He joined the Institute of British Foundrymen in 1910, and was a founder member of the East Midlands branch for which he acted as honorary secretary for many years and later became its president. He was a well-known teacher of foundry practice and acted as examiner for the courses in this subject organized by the City and Guilds of London. His great work for the Institute was recognized by the award of the Meritorious Services medal. During his life he gave much to the industry he was proud to serve.

## Latest Foundry Statistics

The Council of Ironfoundry Associations states that 146,172 ironfoundry workers were employed in the United Kingdom during the week ending March 3. The corresponding earlier figures were: January 28, 146,505, and February 26, 1955, 144,733.

According to the *Bulletin* of the Iron and Steel Board there were on February 4, 20,190 people engaged in the steel foundries, that is 100 fewer than in early January, but 560 more than a year previous. This industry during February produced 6,500 tons of castings as against 6,200 tons in January, and 5,300 tons in February, 1955.

# Dinner

## INSTITUTE OF METALS

The annual dinner of the Institute of Metals was held at Grosvenor House on Wednesday, April 11. The president, Major C. J. P. Ball, D.S.O., M.C., F.R.AE.S., was in the chair. The speeches given by the Most Honourable the Marquis of Reading, P.C. (Minister of State for Foreign Affairs); the Hon. John Greenstone, M.P.; and the Right Reverend the Lord Bishop of Chester, and the chairman, were uniformly brilliant.

# Jobbing Production of Light-alloy Castings

[SLIGHTLY ABRIDGED]

*By A. S. H. Sawers*

MR. SAWERS is general manager of the Aluminium Castings Company, Limited, Greenock. He was with Cruikshanks & Company, Limited, iron, malleable and steel founders, before joining his present company. A member of the Institute of British Foundrymen since 1942, he received the Institute's "Book Award" on gaining the City and Guilds final certificate in patternmaking. He is at present a member of the general Council of the Institute and junior vice-president of the Scottish branch.

*First, a short summary of the Author's normal melting-procedure for aluminium is given, with particular emphasis on the method of preparation prior to pouring, embodying grain-refining, fluxing, degassing and modification. In the body of the Paper, the production of a number of castings from sand moulds and by die-casting is described in detail. The sand-moulded jobs include the making of an exhaust pipe for a marine engine; a stock-pot cooking utensil (24-in. dia.); a marine-turbine cover moulded in a wooden box-part, and several items produced from mounted patterns. Die-cast items described are for lighting fittings, a hot-water bottle, a terminal box and a gearbox rear-cover. In each case, salient features are given of the moulding, running and feeding methods adopted. The Paper also included illustrations (too numerous for reproduction in what follows) of several other jobs typical of those handled in the Author's foundry.*

## Alloy Production

Before dealing in detail with the subject of the production of light-alloy castings, a summary follows of the normal melting-procedure adopted at the Author's foundry for aluminium ingot which may prove advantageous, with particular emphasis on the method of preparation prior to pouring. This embodies grain-refining, fluxing, degassing and modification. It will be noted also, that in a foundry designed principally for small production work, the ability to produce fairly-large castings by the use of wooden moulding-boxes demands a certain amount of improvization, and the fact that this has been successfully accomplished shows the adaptability of such a foundry.

## Temperature Control

The importance of temperature control in melting aluminium alloys is perhaps not fully realized in every foundry. Excessive gas-absorption and dross formation are responsible for a large proportion of defective castings, yet each of these faults can be traced to a melting temperature which is higher than necessary. In addition to these effects, overheating is generally the cause of the very coarse grain-size sometimes seen on fracturing castings and even if the melt is cooled to the correct temperature before casting, some of the ill-effects of overheating will persist. Control of pouring temperature is just as important as melting temperature since, without it, misruns, inadequate feeding or excessive shrinkage will occur. The melting and pouring must be reasonably organized to ensure that the metal is not left in the furnace to become over-heated.

*Pyrometers*

In most portable pyrometers, the thermocouple wires are attached to a short stem which carries the connecting leads and is rigidly fixed to the measuring instrument. The portable instrument is, therefore, self contained and has a pistol-grip handle enabling it to be held and used in one hand. This is the type of pyrometer used in the Author's foundry. It is important that the accuracy of the instrument should be checked from time to time by the manufacturers. A rough check of the accuracy at melting temperatures can be made by measuring the temperature during freezing of a small melt of pure aluminium. The temperature will fall until the aluminium begins to freeze when it will remain steady at 659 deg. C. until the metal has solidified completely.

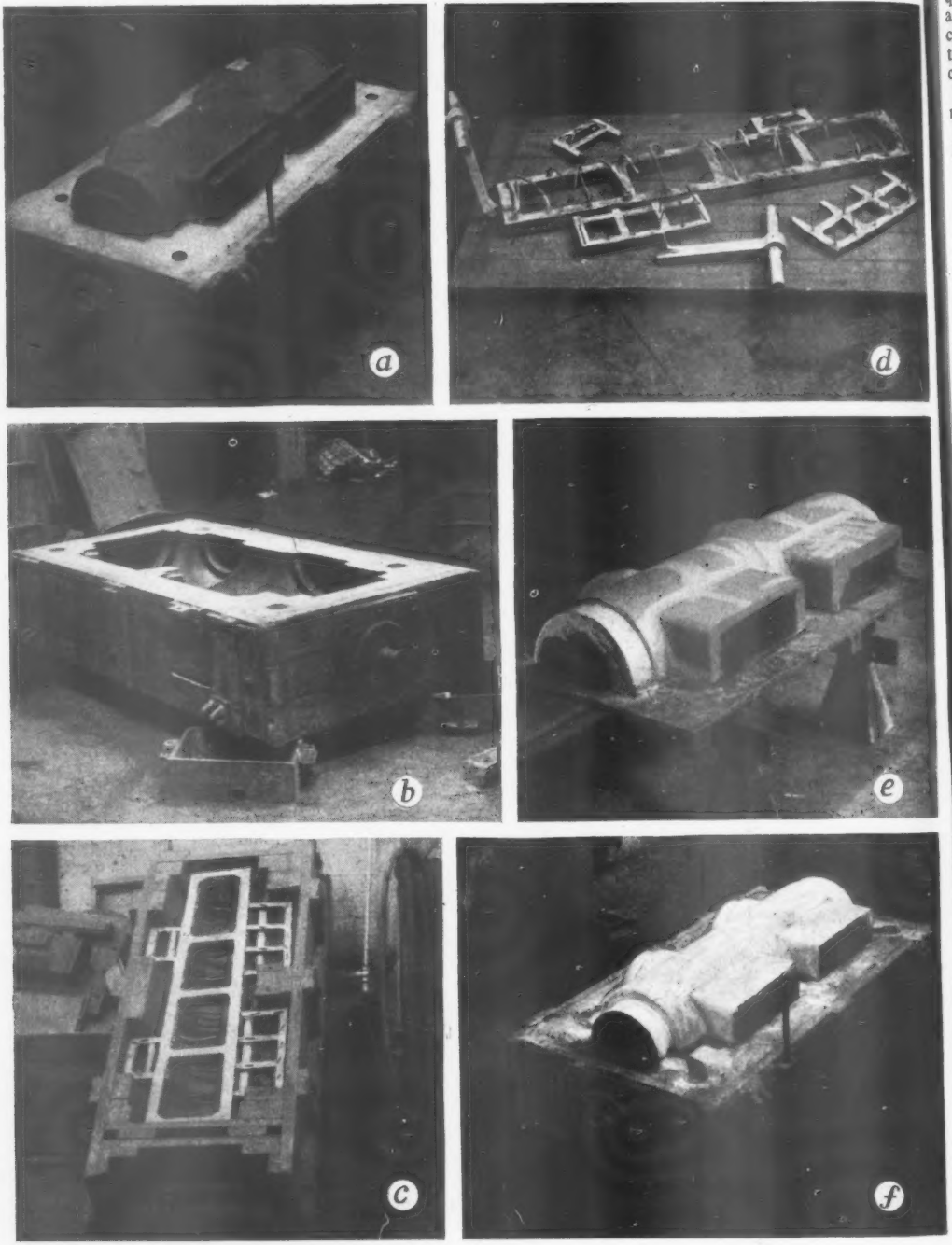
## Grain-refinement

Generally speaking, castings having a coarse grain-structure have poorer mechanical properties, are more unsound and more liable to hot-tearing than similar castings of finer grain. Low melting-temperatures will help to promote a fine grain in castings since the grain-size depends largely upon the rate at which the alloy freezes in the mould. Some casting alloys show more tendency than others to develop a coarse grain-structure. In practice, this is reduced by the presence of grain-refining elements (such as titanium) which are added by the manufacturers. A measure of refinement can be effected, if necessary, by the addition of another refining element, boron. It is usually added as a chemical compound, in the form of a powder or tablet which

* Paper read before the Scottish branch of the Institute of British Foundrymen.

*Production of Light-alloy Castings*

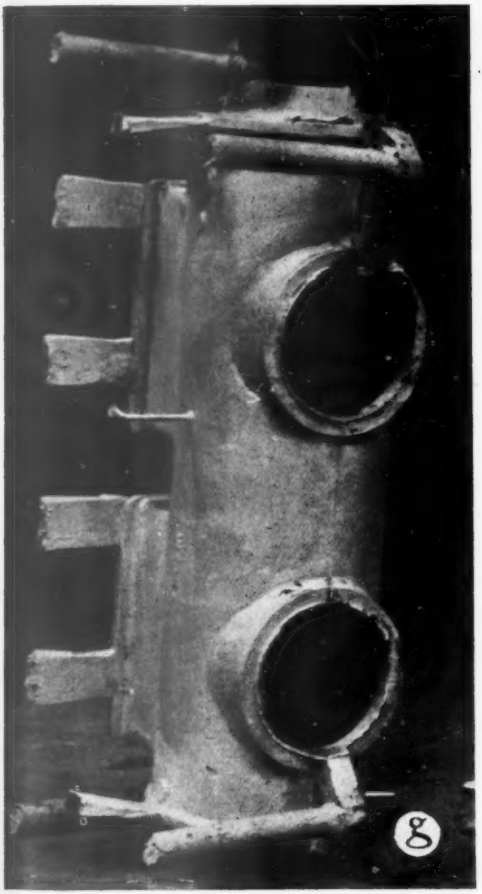
FIG. 1 (*a*) TO (*f*).—*See caption above* FIG. 1 (*g*) *on facing page.*



is plunged into the melt immediately before casting (4 oz. per 100-lb. melt). Such treatments are beneficial in the production of castings which are required to be pressure tight. Temperature in melting and subsequent casting is an important factor in controlling oxide-formation—the lower the temperature, the less likelihood of dross inclusions in the casting.

Aluminium-oxide forms on the metal during melting, but the skin formed effectively prevents further oxidization. Excessive formation of oxide can be avoided simply by disturbing the surface of the metal as little as possible. Since aluminium alloys always have a thin covering of aluminium oxide, the melting of foundry scrap will introduce more oxide into the melt than when ingot is used, as foundry scrap has a large surface-area. By the addition of scrap, there is a tendency for the oxide to separate from the liquid metal very slowly and this has to be removed by fluxing before casting.

FIG. 1 (*facing page*).—*Production of an exhaust pipe for a marine engine; (a) pattern in the drag-half of the mould; (b) cope-half of the mould; (c) corebox and its core-iron; (d) method of assembly of a collapsible core-iron suitable for a half-core; (e) drag-half of the core ready for putting into the drying stove; (f) core in position, note the gating system on the drag-half of the mould; and (g) (below) the casting immediately after the core and collapsible core-iron have been removed.*




## Fluxing

A flux serves two main purposes: (1) it forms a protective covering during melting to minimize the formation of oxide and the absorption of gas, and (2) it cleans the molten metal by removing dross and other metallic impurities. Alloys containing more than 2 per cent. magnesium require a protective covering-flux since they have a tendency to form dross and absorb gas much more quickly than alloys of lower magnesium content or magnesium-free alloys. With magnesium-free alloys, a small amount of oxide will form on the surface of the melt and this can be removed by gently stirring a suitable flux into it. Stirring should be continued until the dross is freed from all adhering metal. If fluxing be efficient, both flux and dross can then be removed as a dry powder, leaving a clean surface of liquid metal. It is essential that the flux be kept dry, as a damp flux will cause porosity in castings.

## Degassing

The use of nitrogen gas is common in degassing practice to-day, as the bubbling of the gas through the metal has a considerable cleaning effect. Oxides and other non-metallic impurities, which may be present in the molten alloy, are either washed to the surface by the gas or, if they consist of heavy particles, sink to the bottom of the crucible. Fifteen minutes is normally allowed as a settling period after the degassing, and during this time, the temperature of the melt increases. As the surface of the melt is broken by the bubbles of nitrogen, it is advisable to cover it with a flux in order to avoid excessive oxidation. This flux will also facilitate the removal of the oxide and other impurities which rise to the surface during the degassing or settling period. In the Author's foundry, degassing is effected through the use of an organic chemical which is solid at ordinary temperatures but which decomposes at aluminium-melting temperatures. Flux manufacturers sell this (hexachloroethene) under a trade name, in the form of powder or tablets in weighed units for melts of various sizes. The flux is used by plunging the required amount to the bottom of the melt in a perforated bell-shaped container of steel or cast-iron, fitted with a long handle. (4-oz. per 100-lb. melt.)

In applying this method, the heat is shut off before the desired pouring-temperature is reached, an interval decided in the light of experience. Then the metal surface is covered with a layer of flux and the degasser plunged into the bottom of the

melt. The temperature at this stage should be between 700 and 750 deg. C. The evolution of gas from the degasser should not be too violent, the smaller the bubbles, the more effective will be the degassing. After standing for 10 or 15 min., the metal should attain the desired pouring-temperature.

### Sodium Modification

If melted and cast without special treatment, the high-silicon alloys (from 8 to 14 per cent.) have poor mechanical properties, little ductility, and when fractured, reveal a coarse crystalline surface. The introduction into the alloys of a very small amount of sodium, a little over 0.01 per cent., makes a remarkable change—the tensile strength of sand cast LM6 alloy is increased by this treatment, known as modification, from 7 to 11 or 13 tons per sq. in., the elongation is increased three to four times and the impact resistance by ten times. Also, after modification it is possible to bend a properly-treated 1-in. dia. test-bar through an angle of roughly 90 deg. and the bar when fractured will show an almost silky texture. Modification with sodium will not be effective below 750 deg. C., but sodium is rapidly lost—by burning—at higher temperatures. To obtain the maximum effect from modification, the metal must be allowed to stand for several minutes after the addition, but when the prescribed time has expired the effect of the treatment gradually decreases and the alloy returns to its original untreated-condition. This is called reversion, the rate at which it occurs increases with increasing metal temperature. Too much or too little sodium may mean greatly over-modified or under-modified castings. It is quite common to find that in one foundry a given amount of sodium, standing time allowed, etc., which produces satisfactory modification with a certain amount of alloy, will not give the same satisfactory results in another.

FIG. 2.—*Stock-pot, 24-in. dia. and 24-in. deep, cast in 99.5 per cent. pure aluminium.*

*Pan*: as-cast 137 lb., gates 16 lb. *Cover*: as-cast 30 lb., gates 8½ lb.

### Salts Method of Modification

A second method of modification is known as the salts method and has the following advantages:—it provides a means of modifying when (1) high casting-temperatures are required, and (2) when gas-free metal is required. Some foundrymen are against the use of the salts method due to the fact that longer melting time is required; the molten salts attack refractory crucibles; reversion is very rapid at the temperature of treatment (850 deg. C.) and the melt tends to be slightly under-modified. In this method the surface of the melt is covered with "salts" (approximately 2 per cent. of the weight of the melt) giving a cover on the surface of the metal of about ½-in. thick. After allowing standing time, the salts layer—which, as the temperature falls, becomes solid again—is removed and the metal poured as quickly as possible. Crucibles must be well cleaned after salts have been used. Neither of the methods of modification is difficult or complicated but each requires careful supervision, since temperatures, standing time, and quantities of modifier must be closely controlled.

### Modification for Die-casting

It is well known that the rapid solidification of castings in chill moulds results in a fine grain-structure and better mechanical properties than in sand castings. When die-casting, it is not necessary to treat high-silicon alloys if the metal is to be cast into thin sections, but in thicker castings, a degree of modification is necessary to prevent the formation of internal-shrinkage cavities and to give good mechanical properties. The quantity of sodium used in this case is about ¼ to ⅓ of that required for sand casting, and it will be retained for an hour or more in the metal. It is preferable to supply modified metal to the die-casting furnace from a holding furnace rather than add unmodified-metal direct.

## CASTINGS PRODUCTION

In the next section the Author describes and illustrates the production of a number of castings at his foundry, dealing with alloy chosen, moulding method, special features, etc. All these are sand moulded and undertaken on a jobbing basis.

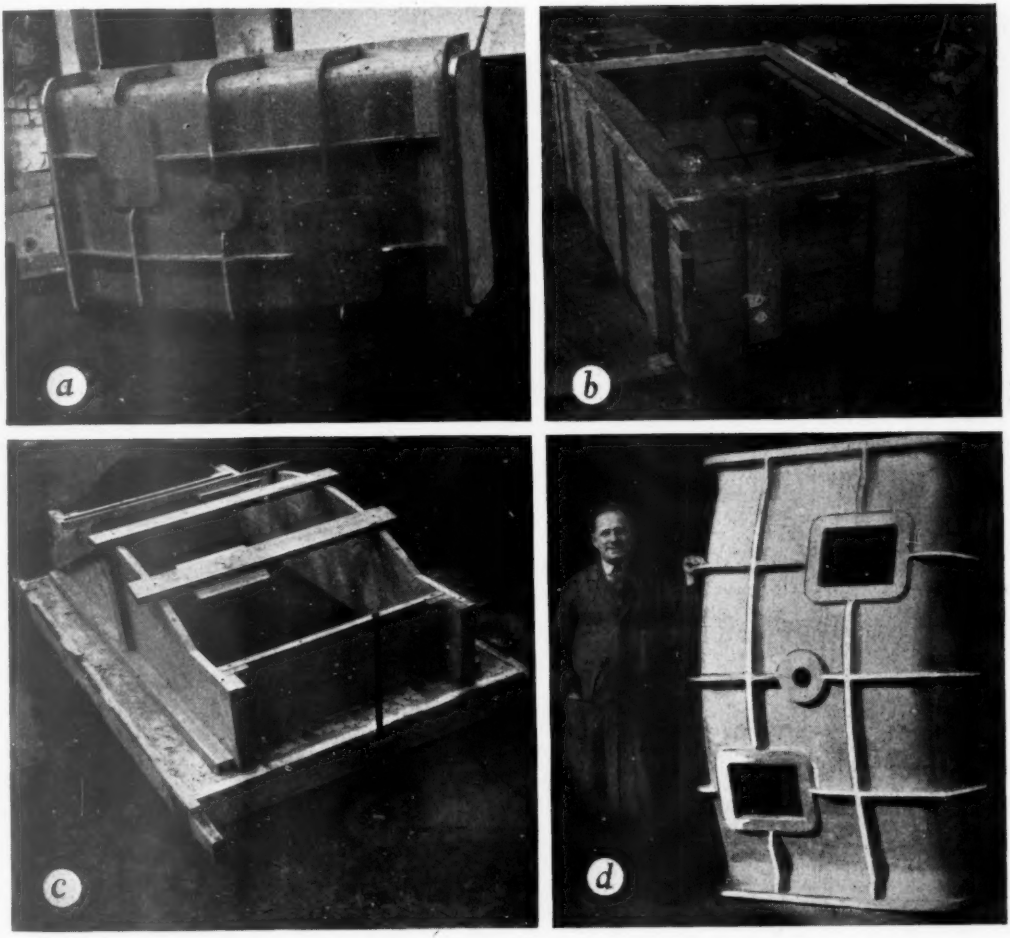
### Exhaust Pipe

Fig. 1 shows the method of moulding an exhaust pipe suitable for a marine engine in a green-sand mould. The pattern is made of wood and split for moulding as shown. The size of the casting is 5 ft. by 2 ft., measured across the ports; the bore of the pipe is 1 ft. 6 in.; the round ports 13-in. dia. and the rectangular ports 21 in. by 14 in. The inside sizes of the moulding box selected are 6 ft. 2 in. by 3 ft. 2 in. by 3 ft. deep. The drag half of the pattern is placed on

a board and rammed up in the usual manner. Prior to ramming the pattern, pieces of metal shaped to suit the core prints are placed in position and wedged tight against the bars of the box. This is done as a precautionary measure to support the weight of the core and prevent it sinking into the prints of the green-sand mould, as the core, when in position, weighs approximately 6½ cwt. With the drag half of the mould rammed up and turned over, the other half of the pattern, along with the gates and risers rammed up where required, is placed in position and parted as shown in (*b*). The top half of the pattern is removed and the mould finished ready for closing.

Fig. 1 (*c*) shows the rather heavy, core-iron required to produce the core for the exhaust pipe. Originally, every core-iron had to be broken up during the removal of the core from the casting, and this entailed a coremaker producing new core-irons every day as a fairly large number of these pipes were required. Nowadays, however, a collapsible core-iron is used and Fig. 1 (*d*) illustrates the method of its assembly for producing a half core. The iron for the main bore of the pipe is in one piece with cast slots opposite the large and small ports. The side members of the iron are placed in their respective slots and driven tightly into position. If there be any slackness due to wear and tear, small wedges are fixed where required, giving a composite core-iron as rigidly built as a single-piece core-iron. On either end are rectangular slots made so that the

FIG. 3.—*Manufacture of a main cover for a marine turbine, in LM6 alloy; (a) wooden pattern, suitable for green-sand moulding; (b) top-part mould in the wooden moulding-box; (c) skeleton corebox; (d) casting, with finished weight of* 387 *lb.*



handles shown can be used in the lowering of the drag half and top half of the core into position in the mould. The main advantage of having this slot rectangular is that it prevents any tendency for the core to turn as it is being lowered into the mould. When the core is in position, the handles are pulled back and removed very easily.

Fig. 1 (*e*) shows the drag half of the core, ready to be pushed into the drying stove. This core is made from floor sand and has no added bond, the same natural sand being employed as that used for the ramming up of the mould. The core is washed with a proprietary coating prior to being stoved. The drag half only of the core is dried, the top half being left " green." Fig. 1 (*f*) shows the core in position. The whiteness of the core as illustrated is due to a powder which has been found to give a good finish to the casting, in addition to acting as a parting agent. The gating system can be seen quite clearly on the drag half of the mould. The complete mould is skin-dried prior to core placing, and also before final closing.

Fig. 1 (*g*) illustrates the exhaust-pipe casting immediately after the core and the collapsible core-iron have been removed. The gates and risers are clearly visible. This casting was produced in alloy LM4 (DTD 424) and had mechanical and chemical properties as follow:—

*Mechanical Properties.*—Tensile 9 tons per sq. in. (min.) and elongation 2 per cent. (min.).

*Chemical Composition.*—Cu 2.0 to 4.0; Mg 0.15; Si 4.0 to 6.0; Fe 0.8; Mn 0.3 to 0.7; Ni 0.35; Zn 0.3; Pb 0.1; Sn 0.05; and Ti 0.2 per cent.

*Casting Weights.*—As cast, 390 lb.; gates, 165 lb.; and as finished, 225 lb.

### Stockpot

The making of pot-and-pan castings is often looked upon as requiring foundry skill of a low order, but in actual fact, when they are cast in pure aluminium, which has a shrinkage as great as that of steel, the same problems arise as are experienced with engineering castings. Fig. 2 shows a stock-pot 24-in. dia. and 24-in. deep, cast in 99.5 per cent. pure aluminium. This is moulded with a metal shell pattern, the bottom being loose for easy ramming so as to leave its own core. The mould is necessarily made in green-sand, since no dry-sand work is carried out at the Author's foundry. Additionally, a green-sand mould is essential, due to the high shrinkage of pure aluminium, which necessitates the use of a core which will collapse easily when solidification of the metal takes place, thus preventing cracking of the casting.

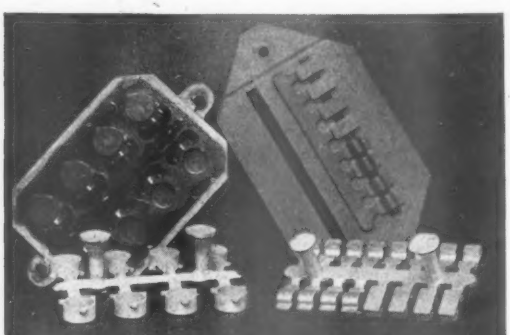
The mark appearing on the casting (Fig. 2) is not a flaw, but a trade mark. As evidence of the long life of these utensils in service, some have been returned in good condition after 45 years' continuous use. These are renovated by re-grinding the bases to make them suitable for use on electric hot-plates and returned to the customer apparently good for many more years.

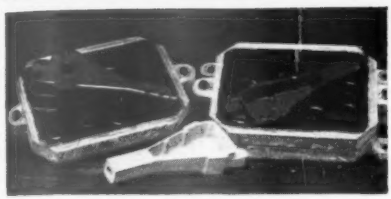
### Marine Turbine Cover

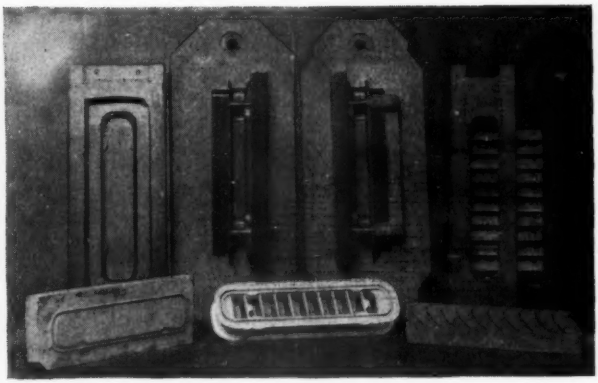
Fig. 3 (*a*) shows the wooden pattern used in making a casting in green-sand of a main cover for a marine turbine. Only one casting was required in alloy LM6, more commonly known as 2L33 or Alpax. The tensile strength of this alloy is 10.5 tons per sq. in., the elongation 5 per cent., and it has an excellent casting fluidity. Its chemical composition is:—Cu 0.10; Mg 0.10; Si 10.0 to 13.0; Fe 0.6; Mn 0.5; Ni 0.1; Zn 0.1; Pb 0.1; and Sn 0.05 per cent. The alloy has good corrosion resistance and ductility along with medium strength; it is particularly suitable for thin-section work, and for all types of casings, covers, pump bodies, and the like. The box part used in making this casting measured 8 ft. by 5 ft. by 5 ft., and was made of wood strengthened with steel rods and plates to give a fair amount of rigidity. This mould was

FIG. 4.—*Channel-block casting with an as-cast weight of 4 lb., and as-fettled, 3 lb.*

FIG. 5.—*" Up-and-down " method of moulding for (left) electrical terminal boxes and (right) cable clamps.*







FIGS. 6 TO 8.—*Selection of matchplate patterns;* FIG. 6 (*top, left*), *pattern board for a louvre casting;* FIG. 7, *tackle used in the making of an end-louvre to be fixed on the outer casing of an electric motor;* FIG. 8 (*bottom, left*), *plaster matchplate used in the manufacture of a gearbox for a silage cutter.*

made in the crane bay, the lifting capacity of the manually-operated crane being 3 tons.

Commencing moulding, the pattern was placed in position in the drag, and the underside of the flange was rammed up to this level, so forming the print location for the corebox. After the joint was made and the top part of the box placed in position, the mould was continued in the usual manner. Due to the use of a wooden box, the mould was strengthened with gaggers and not with hangers as one would expect. With wooden box-parts, if the normal hangers are used and fixed to the top bars of the box, it is found that there is a tendency for the mould shape to pull away in parts, on account of the yielding of the wood, but this tendency is practically eliminated by using gaggers. The gaggers were made in moulding boxes, the length depending on the number of box parts used. Three sections of a box 20-in. square gave 64 gaggers. The use of this method resulted in a great saving of floor space by eliminating a sand bed. The box, see Fig. 3 (*b*), was kept as small as possible to facilitate handling and, in consequence, the gating of the casting on this occasion was arranged on the end flanges. The type of casting warranted this method of gating, to ensure the supply of metal at high temperature all over the mould and so prevent the possibility of cold shut. Risers were taken from the two cover flanges and the central boss at the top. The box was parted by rope slings instead of chain or wire slings as one would expect. This was necessary to prevent damage to the box part when it was rolled over for the withdrawal of the pattern, which was lifted along with the top part. After the withdrawal of the pattern, the top part of the mould was finished and then dusted over with a proprietary powder to make it ready for closing.

The corebox used (see Fig. 3 (*c*)), was of the skeleton type, and was placed in position over the impression of the print left by the pattern in the drag. A strickle bar was provided to give the required radii at the top of the corebox, and the location prints for the top flanges are shown in position in the illustration. This method eliminated the necessity for core-irons and for lifting a fair-sized core from a corebox into the mould. At the same time, accuracy of core location was ensured. The centre portion of the core was built up of brick, etc., leaving approximately 6 in. of facing sand. The corebox, which had a fair taper on the sides, was lifted off, leaving the core to be finished and dusted with powder.

The pattern having been withdrawn from the top part of the mould, the inside had to be braced across with lengths of timber to take the weight of the sand (which was then unsupported) when the box part was being turned over into its original position prior to closing and casting. Due to the likelihood of pin-hole porosity, caused by the absorption of gas from the sand in the mould, a flame was played over the completed mould and this helped to eliminate the possibility of trouble. Fig. 3 (*d*) shows the finished casting which as-cast weighed 530 lb., the gates being 143 lb.

### Mounted Patterns

In some cases, where repeat orders for castings of this type are likely, the patterns are mounted on reinforced wooden boards or plaster odd-sides as required. One example of this type of production is shown in Fig. 4, which illustrates channel-block castings and the pattern set-up for their production. Three patterns are fixed on a flat board, the gating also being fixed in position. The casting is machined all over.

*"Up-and-down" Moulding.*

Fig. 5 demonstrates the "up-and-down" method of moulding. The spray of castings on the left hand

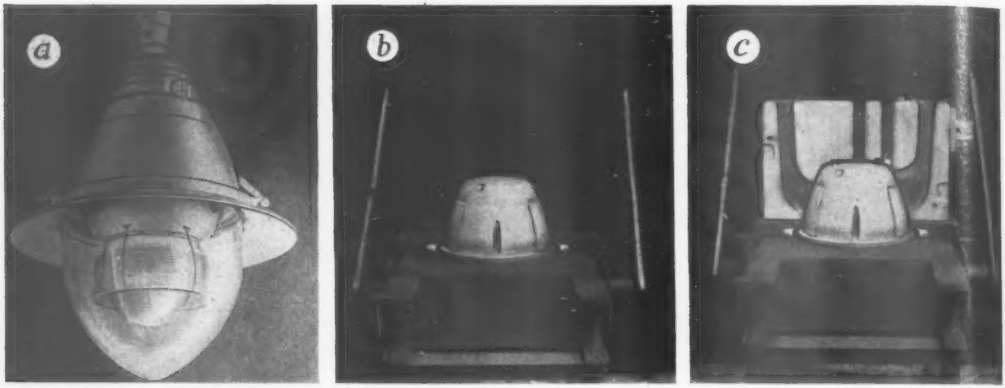



FIG. 9.—*Production of lantern components, (a) finished lantern, (b) main core, and (c) die blocks and metal section, runners and risers and metal cores in their respective positions ready for pouring.*

of the illustration shows, in the background, four electrical terminal boxes cast upside down, in the foreground, the other four castings on the spray in a face-upwards position, the same patternplate giving moulds for both cope and drag. When closing the boxes it is essential that the cope be reversed to ensure that it corresponds with the impression in the drag. On the right of Fig. 5 are some cable clamps, which demonstrate another simple method of casting "up and down." Here it will be noted that the patterns are on one side only of the board, placed over a long coreprint. Opposite these patterns is the same length of coreprint but on this side it is reversed, *i.e.*, cut out of the board so that on reversal of the mould boxes clamps are produced in an "up-and-down" position. It will be seen that there are four top-type and four base-type castings on either side of the spray.

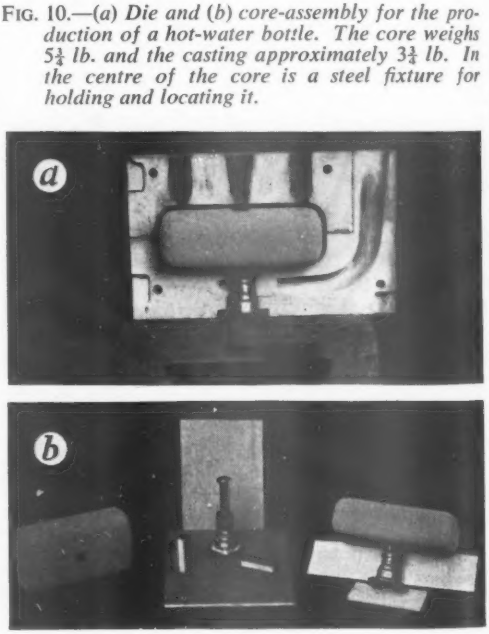
*Matchplates*

Fig. 6 shows a matchplate pattern mounted on a pattern board to produce a louvre casting. The full outside shape of the louvre can be seen on the right-hand board whilst the left-hand bears the cut-out recess forming the groove in the casting for a sealing strip of rubber. In the centre is the core-box used to make the core shown in the left foreground, and in the right foreground is a finished casting.

Another matchplate, shown Fig. 7, is used in the making of an end-louvre to be fixed on the outer casing of an electric motor. In this case, the manufacture of the pattern has to be more accurate than that shown in Fig. 6, due to the fact that the actual casting, as shown, has to be made in two parts which must match perfectly one with the other. In this instance, the gating system can be seen—metal passing over one of the cores. The right and left-hand coreboxes produce their respective cores which are seen in the foreground. The core forming the groove in the casting is jointed on to the top of the louvre core (right-hand side), which is then placed into the mould in one piece. This casting weighs 6¼ lb.

Fig. 8 illustrates a match-plate pattern which, on account of its shape, is made in plaster. The casting is for a gear-box for a silage cutter and weighs 4¼ lb. It will be seen that the pattern is rather a close fit for the size of the moulding box. It was hoped to make it on one of the smallest moulding machines available but eventually a turnover

FIG. 10.—(*a*) *Die and* (*b*) *core-assembly for the production of a hot-water bottle. The core weighs 5¼ lb. and the casting approximately 3¾ lb. In the centre of the core is a steel fixture for holding and locating it.*



machine had to be used owing to the depth of draw required, as shown on the right-hand of Fig. 8, whereas the half mould from the pattern on the left was made on a straight jolt/squeeze/pin-lift type of machine (jolting being omitted in this case). The box pattern (right) shows how extra lugs were provided for clamping the job to the moulding table on the roll-over type of machine. The purpose of the raised pieces on one half-pattern and the corresponding hollows in the other is to conform to the dictum that no matter how accurately pins and box-part holes are made, a few extra location points are worth while.

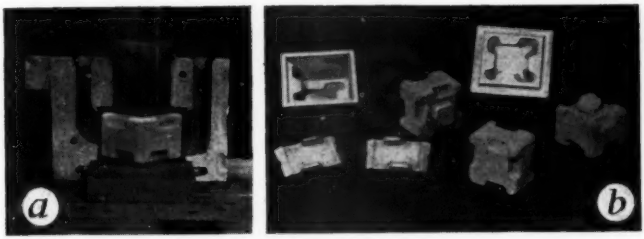



FIG. 11.—*Set-up for producing a four-way terminal box as a gravity-die-casting; (a) die and (b) metal corebox used in producing the sand core.*

## DIE-CASTING

In comparison with sandcastings, the finish of die-castings is much smoother and dimensional accuracy is greatly improved; machining allowance can therefore be much less. Relatively complex shapes can be produced; as dies are expensive, however, die-casting is only economical where fairly-large numbers are called for; in most cases 1,000 to 2,000 is considered the minimum quantity to justify die-casting. Undercut internal shapes necessitate the use of either sand-cores or collapsible metal-cores, which can be difficult and costly to produce.

The main blocks of a gravity die consist of a good, close-grain iron such as Meehanite, which is readily machined and has good heat-resisting qualities. The cores are normally made from mild steel. The die is usually of a ribbed structure, the design of which is governed by the actual casting in the die and depends on what sections will require to be thicker than others in order to promote steady solidification. There are three recognized methods of pouring into a die:—(*a*) top pouring (which has a tendency towards turbulence), (*b*) side pouring, and (*c*) bottom pouring. The last two methods give a smoother flow to the metal stream, bottom pouring, of course, being most suitable in avoiding the trapping of air in a casting. The die has to be operated at a steady temperature, this, normally, being determined by the speed and quality of the castings which can be produced from the die. Runner design depends considerably on the fluidity of the alloy to be used and the area to be filled with molten metal.

The majority of the castings illustrated in what follows are produced in either LM4 or LM6 (DTD424 or 2L33) alloys. LM6 is much more fluid than LM4 which can be a rather sluggish-running metal, but no undue trouble is experienced when casting with either. In LM4 castings, the die-coating has usually to be of a rather smooth texture, whereas with LM6, one finds that the casting can only be produced using a semi-coarse coating, when rather thin sections are encountered. It may appear strange, but castings produced in LM6 tend to show blow-marks; this in spite of the fact that, as mentioned earlier, LM6 is very fluid compared with LM4. Melting temperatures with LM6 are approximately 680 deg. C., and for LM4 are 740 to 750 deg. C. The structure and design of the casting are important when determining pouring temperature.

It is essential that the die operator, when pouring metal into the die, shall not at any time allow the stream of metal to be broken, because if this happens, air is liable to be trapped in the die. Venting of the die is extremely important, so the die-joint face is vented by means of shallow grooves which cross the die-joint from the casting to the outer edge of the blocks. The grooves are normally 0.005-in. deep at the casting increasing to 0.010 to 0.015-in. at the outer edge. If the vents be increased in size beyond the dimensions quoted, there is a possibility of metal "flashing" down these grooves thus blocking the air vents and causing production delays. An alternative method of venting is by the insertion of vent pins where fairly large areas and bosses are encountered. If the venting in a die is not properly carried out, the casting will have holes formed by air-locks and will also have edges rounded where they should be sharp.

### Die-coats

The type of coating to be applied to the runners and risers depends upon the type of casting to be made (whether of thick or thin section), the composition of the alloy, and its fluidity. The coating provides a protection against erosion by the aluminium and assists fluidity. The manner in which the coatings are applied by the die operator can either hasten or retard solidification. The application of a heavy coating where there are thin sections will delay this and a thin coating, or complete removal of the coating by a wire brush after spraying, will tend to speed solidification. A thick coating is generally applied to runners and risers in order that the metal can be kept molten as long as judged necessary to feed the casting. There is quite a selection of proprietary brand die-coats on the market and the Author makes use of several. It

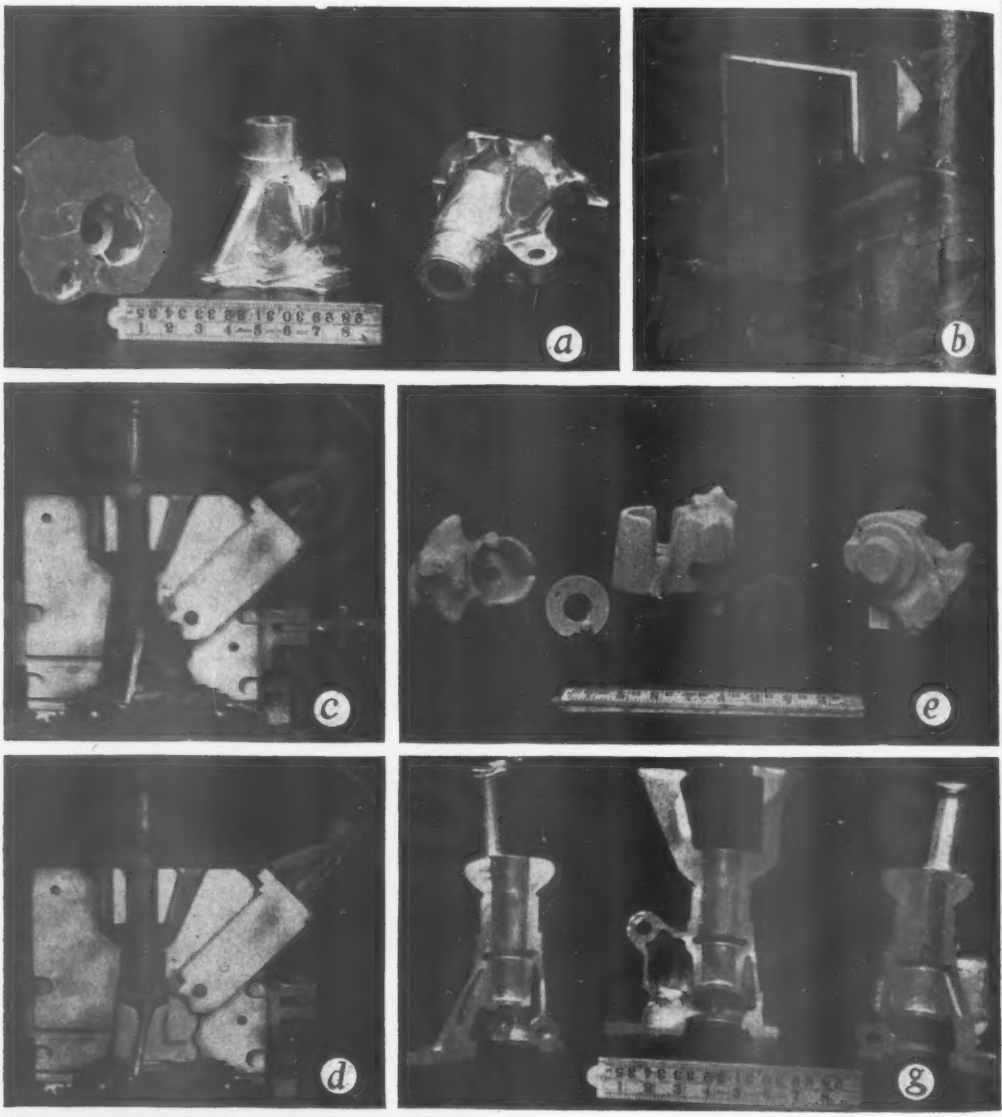



FIG. 12.—*Method of manufacturing a gearbox rear cover for the motor-car industry: (a) finished casting; (b) die mounted on tubular-steel frame; (c) die, showing the positioning of the metal cores; (d) sand- and metal-cores in position; (e) design shape of the sand cores; (f) metal core-box consisting of a main box, two side-pieces and a cover-plate; (g) section of the gearbox cover and in the centre a section through the runner and riser.*

was found, however, that a simple mixture of talc, sodium silicate, and hot water to a thick or thin consistency at will, produces quite a good die-coat for general use. The coating is applied by spray on to the die face, the heat of which is sufficient to dry it without flaking, or blistering, on the die impression. Some die-casting foundries use furnaces to heat their dies in order that they will be ready for use as soon as fixed to the die tables, but the Author's foundry prefers gas pokers for the same purpose. The die is fixed on the table and a sheet-metal cover is placed over it, this cover confining the heat around the die. In die-casting, there is a likelihood of metal adhering to moving cores and to prevent this, they are occasionally removed from the die and dipped into a graphite-and-water suspension. This gives the lubrication necessary, plus a chilling effect when the metal comes into contact with the dipped cores.

### Road-lighting Fitting

Fig. 9 illustrates the production as a die-casting of the main body for a lantern for public lighting. In the centre view, the side blocks of the die have been removed leaving the main core exposed. This core is the "drop" type, *i.e.*, by pulling the side handles, it can be lowered by means of a simple cam arrangement, leaving the casting free to be lifted from the die. Attached to core on either side can be seen loose-pieces which form lugs on the inside of the casting, which are held in position by a dovetailed groove so that accurate and rapid replacement on to the main core can be effected after their removal from the previous casting. This assists in maintaining the necessary temperature in the die for the pouring of the following casting. In the right-hand illustration, the die blocks are back in position and clearly shown are the metal section, the runners and risers, and the metal cores in their respective positions. The amount of metal required for the pouring of this casting is 10¼ lb., giving a finished weight of 6¼ lb. A view of the complete lantern is shown on the left in Fig. 9. Other components die-cast for the lantern include the reflector (3 lb. 6½ oz.) and the top level dome (with aluminium bronze insert) (2 lb.) (without insert, 1 lb.).

### Hot-water Bottle

A die for the production of a hot-water bottle and the necessary sand core in position, are shown in Fig. 10. The weight of the core is 5¾ lb. and the casting approximately 3¾ lb. This heavy type of cast hot-water bottle is made primarily to suit the requirements of the hotels and hospitals. Fig. 10 (*b*) illustrates the assembly necessary for this core to ensure an even thickness of metal in the bottle when cast. In the centre can be seen the steel fixture for the holding and location of the core. It consists of a base and a square-section rod over which is placed a collar, the latter forming the screw in the bottle. The sand core is made with a square section metal insert which is ultimately placed over the rod. A flat-headed screw is fixed on top of the sand core to prevent metal running into the hollow rod, this being the only means of venting the core. The assembled core is shown, ready to be placed in the die. The screw-threaded section is dipped into a graphite solution, thus preventing the metal from adhering to it when pouring. Sand cores used in dies must not be too hard and should yield when contraction takes place; in consequence, they have to be handled very carefully. In certain metals, cracks may be formed if free contraction is restrained by prior solidification of some sections of complex castings, particularly where cores are used. Such cracks are known as hot-tears, and the possibility of their occurence must be borne in mind when selection of the alloy is being considered for a particular job. Aluminium/silicon alloys such as LM6 and LM9, and the aluminium/silicon/copper alloy, LM4, are least susceptible to this trouble.

### Terminal Box

Fig. 11 shows another example of a sand core being used in a gravity-die-casting. The casting is for a 4-way terminal box which, by the selective removal of metal pads and the replacement of metal cores, can be cast and used as either a 1-, 2-, 3- or 4-way box. Fig. 11 (*b*) shows the metal corebox used. It consists of a main box-part carrying the print which matches the die location; there are four loose side pads, and when these are assembled, the top cover is placed in position, holding the loose pads firm prior to blowing of the core. The core is blown through the shaped hole, which is the actual coreprint for location purposes in the die.

A gearbox rear cover used in the motor-car industry is shown in Fig. 12, together with details of the die design and method used. The casting itself is illustrated in Fig. 12 (*a*); Fig. 12 (*b*) shows the closed die, mounted on a tubular steel frame, at a suitable height for easy pouring of the metal down the runner, and 12 (*c*) the die itself, revealing the positioning of the metal cores, one of which comes up through the base at a distinct angle. This core is approximately 6-in. iong, tapering from ½-in. dia. to an oval shape ($\frac{7}{16}$ by $\frac{5}{16}$ in.) at the point of connection with a sand core. There are five metal and two sand cores used in the production of this casting. Fig. 12 (*d*) shows the sand and metal cores in position. Originally, the small ring-core was part of a main sand-core which extended about 2 in. up the neck of the casting and was held in position by the metal core, which also acted as a chill in this fairly heavy section. This idea was subsequently discarded because of the washing action of the metal on the relatively soft sand-core, which tended to leave "dirt" in the casting. Also, since a maximum machining allowance of $\frac{1}{32}$ in. per side was required, difficulty was experienced in holding this main core concentric with the bore in the neck of the casting. The difficulty was eventually overcome by extending the metal core to meet the main sand-core, and by means of a loose part which unscrewed, the small ring-core was accurately and quickly located. The ½-in. dia. metal-core can be clearly seen in position just touching the sand ring-core. Using this method, a bore free from sand

*Production of Light-alloy Castings*

inclusions and with the minimum of machining allowance was ensured.

Fig. 12 (*e*) shows the design and shape of the sand cores. The metal core is shown with the sand ring-core in position and also to be seen is the metal print which locates it in position in the main core. Fig. 12 (*f*) illustrates the metal corebox. It consists of the main box, two side-pieces and a cover-plate. Unfortunately, the background of the photograph does not show too clearly the hole by means of which the core is located in the base of the die and which also acts as a blowing-hole for the corebox. Fig. 12 (*g*) shows a section of the gearbox cover and in the centre is a casting sectioned about the runner and riser.

**Acknowledgments**

In conclusion, the Author expresses thanks to the directors of the Aluminium Castings Company, Limited, Greenock, and to members of the staff for their co-operation in preparing this Paper. His appreciation is also extended to Mr. W. Anderson, M.I.B.F., of Barr & Company (Brassfounders), Limited, Greenock, for his contribution by way of illustrations.

## British Compressed Air Society

The annual general meeting of the British Compressed Air Society and the annual luncheon were both held on March 22 at the May Fair Hotel, London.

The Council for the year 1956/57 are as follows:—Aerograph Company, Limited; Belliss & Morcom, Limited; Climax Rock Drill & Engineering Works, Limited; Consolidated Pneumatic Tool Company, Limited; Hick, Hargreaves & Company, Limited; Lacy-Hulbert & Company, Limited; Tilghman's, Limited; and Williams & James (Engineers), Limited. *Associate Council Members:* Burgess Products, Limited, and Metallic Valve Company, Limited. At the first meeting of the new Council, the following officers were appointed:—*President*—Mr. G. F. Davies (Hick, Hargreaves & Company, Limited); *Vice-president*—Mr. Charles Pike (Aerograph Company, Limited); *Ex-officio Council member* (immediate past-president). (Mr. J. R. Quertier re-appointed hon. technical director.)

### BSI Information

The British Standards *Information Sheet* for March under *Amendment Slips Issued* includes one to B.S. 497:152 Cast manhole-covers, road gully-gratings and frames for drainage purposes (amendment No. 2), PD 2405 and to B.S. 1651:1950 Industrial safety gloves (amendment No. 4), PD 2402. Under *Future Publications* is listed B.S. 2737:1956 Terminology of internal defects in castings as revealed by radiography (12s. 6d.), and *New Work Started* includes: Cast-iron boilers for central heating and hot-water supply (revision of B.S. 779); Tyres for crane rail-wheels; and cast-iron surface plates and granite surface-plates (revision of B.S. 817), a draft of this latter is being circulated for comment. Among reprints now available is PD 364 (STA 7) Non-ferrous metals and alloys for armaments and general engineering purposes—Aluminium and its alloys (4s.).

## Iron-ore Imports

The appended table shows the tonnage of iron-ore imports in January and February, 1956, and includes totals for the first two months of 1955 and 1956.

| Destination. | Month ended Jan. 31. | Month ended Feb. 29. | Two months ended February 29. | |
|---|---|---|---|---|
| | 1956. | 1956. | 1955. | 1956. |
| | Tons. | Tons. | Tons. | Tons. |
| Sierra Leone .. | 66,230 | 35,150 | 74,435 | 101,380 |
| Canada .. .. | 86,718 | 79,805 | 80,011 | 165,469 |
| Other Commonwealth countries and Eire | 1,154 | 1,975 | 2,483 | 3,129 |
| Sweden .. .. | 368,591 | 301,440 | 572,633 | 670,100 |
| Norway .. .. | 11,745 | 4,705 | 13,166 | 16,450 |
| Western Germany .. | 1,470 | 1,460 | 10,044 | 2,930 |
| France .. .. | 55,284 | 48,139 | 82,853 | 102,978 |
| Portugal .. .. | 5,650 | 9,055 | 4,768 | 14,705 |
| Spain .. .. .. | 69,863 | 65,976 | 97,697 | 135,839 |
| Algeria .. .. | 152,641 | 110,270 | 309,919 | 262,896 |
| Tunisia .. .. | 88,162 | 52,280 | 108,474 | 140,442 |
| French Morocco .. | 29,375 | 34,777 | 43,306 | 64,152 |
| French West Africa .. | 77,431 | 57,672 | 66,357 | 135,103 |
| Spanish Morocco .. | 31,995 | 27,975 | 29,600 | 59,970 |
| Liberia .. .. | 19,920 | 18,640 | 48,330 | 38,560 |
| Brazil .. .. .. | 40,255 | 57,745 | 43,580 | 98,000 |
| Other foreign countries | 48,458 | 37,953 | 5,563 | 86,397 |
| TOTAL .. .. | 1,154,942 | 945,017 | 1,593,219 | 2,098,500 |

## Higher Steel Target

Steel production this year should exceed that of 1955 by 1,500,000 tons, according to the Iron and Steel Board's estimate. This would raise 1956 output to about 21,300,000 tons.

Provisional results of the census of consumers' stocks of steel taken by the board in December indicate that total stocks rose by about 7 per cent. in 1955. The largest increase in consumers' stocks during the year was in steel sheet, reserves of which rose by 47 per cent.

During February steel output was maintained at a weekly rate of 417,800 tons, which was the highest for any month, the previous best being 408,600 tons a week in November, 1955. The annual rate of production during the month was 21,724,000 tons, compared with 20,498,000 tons in the same month last year and 21,069,000 tons in January this year.

A new record weekly rate of pig-iron production was established in February, at 263,300 tons. The annual rate achieved during the month was 13,692,000 tons, against 12,567,000 tons in February, 1955.

The following table gives the latest steel and pig-iron output figures (in tons) and compares them with earlier returns:—

| Period. | Pig-iron. | | Steel ingots and castings. | |
|---|---|---|---|---|
| | Weekly average. | Annual rate. | Weekly average. | Annual rate. |
| 1956—January .. | 260,700 | 13,558,000 | 405,200 | 21,069,000 |
| February .. | 263,300 | 13,692,000 | 417,800 | 21,724,000 |
| 1955—January .. | 236,400 | 12,292,000 | 380,600 | 19,789,000 |
| February .. | 241,700 | 12,567,000 | 394,200 | 20,498,000 |
| December .. | 250,100 | 13,004,000 | 381,900 | 19,860,000 |
| 1954—December .. | 233,600 | 12,149,000 | 354,700 | 18,442,000 |

# $CO_2$ Process Discussions

## *BCIRA Conference in London, March 21 and 22*

At a conference (in London at the Charing Cross Hotel on March 21 and 22) organized by the British Cast Iron Research Association to discuss the $CO_2$ Process, a series of papers was presented by research workers, by suppliers of $CO_2$-sand materials, and by founders using the Process. Trying to assess the various contributions, it appeared there was fair agreement on the broad general principles of the Process, and a divergence in opinion on the details of its application in individual foundries. Thus, there was disagreement as to the use of organic additions to the sand, wet or dry sand, dressings for moulds and cores, ease of stripping, and economics. Summaries of the papers presented and the ensuing discussion are briefly given in this report and it is understood that full accounts will be published by the Association in due course.

### Wednesday Proceedings

Following the formal opening of the conference by Mr. S. H. Russell, president of the Association, who took the chair, MR. A. TIPPER (Harborough Construction Company, Limited), speaking, of course, as a supplier of material for the Process, began the series of reports by saying that 400 to 500 foundries were now using $CO_2$ in production and 1,000 tons of $CO_2$ sand were mixed weekly. The work had been started about eight years previously when the $CO_2$ Process was used mainly for cores. However, it was now being used for moulds and this was rapidly becoming the major use. Nowadays, it was being adapted to most types of alloy, from magnesium to steel, including most types of cast iron, on castings ranging from a few oz. up to 10 tons in weight, and the $CO_2$ Process was also being applied in the production of relatively-thin moulds for small repetition work.

The limitations of $CO_2$ moulding were that it was more expensive than green-sand moulding, while a $CO_2$ core had a lower strength than a corresponding dry, oil-sand core. Sand burn-on was still a problem in iron foundries and penetration was experienced at heavy sections and at "hot spots." One remedy was to use a higher addition of binder, and another to employ a good mould dressing. Steel seemed to frit the $CO_2$ sand and give a clean face to the casting, possibly by a slagging-and-sealing-off mechanism.

The limited experience gained to date showed little $CO_2$-sand contamination with base sands and a sand *p*H of 8 to 9 was desirable. It had been suggested that possible health hazards might arise from dermatitis and silicosis; these, however, were considered slight.

Another representative of a "supply" firm, DR. D. V. ATTERTON (Foundry Services, Limited), then dealt with the theory of the bonding action of a $CO_2$ binder. He said that one should avoid complete gassing, and rely to some extent on air evaporation. Over-gassing was manifested by the formation of sodium bicarbonate. A ball-clay addition to the sand mix could be used to give a green-strength of 2½ to 3 lb. per sq. in. In experimental work, the type of surface obtained on test castings with standard sands and various additions had been assessed by "feel" of the surface as compared with those of six arbitrary standard castings. Dealing with the effect of temperature on the strength of the sand, he showed that there was a rapid rise in the strength/temperature curve above 800 deg. C. with a peak at about 1,200 deg. C. (according to Schumacher).

Dr. Atterton also suggested various means for introducing $CO_2$ to cores and moulds. A favoured method of gassing a mould, he said, was by the use of a pattern vented with core vents. Gas was then led in from the pattern to the mould either *via* a hollow pattern or by drilling holes to the back of the pattern and leading in the gas from behind. A suggested spacing of the vents was 4-in. apart. Examples of the production of $CO_2$ moulds and cores were also presented by this speaker.

### Practical Experience

MR. A. TALBOT (Western Foundries) then showed a film and subsequently during the proceedings gave particulars of his practical experience of the use of the Process for both cores and moulds. The use of $CO_2$ sand in his foundry, he claimed, had given a 70 per cent. productivity increase due, in part, to quicker turn-round of patterns and equipment and lower handling costs. During the 18 months in which $CO_2$ had been used, the green-sand finish had also improved. Milling of the $CO_2$-sand mix was very important, though orthodox techniques were employed; clay additions to the sand he regarded as "disastrous." A powdered silicate binder could be used and he preferred this for ease of handling. The same sand mix was used in his foundry for gunmetal and cast iron, but for aluminium alloys, wood-flour was also added. He suggested that the sand should be mixed about six hours before use, so that it needed less gassing time —about 15 instead of 20 sec. He did not favour a pelleted-pitch addition because it gave fumes which would not ignite; he considered coal-dust was better. Mixed $CO_2$ sand could be kept for 10 days, if it was covered with a damp sack, and the sand bench-"life" was greater when a dry binder was employed than when a wet binder was adopted.

In gassing, $CO_2$ could be diluted with air to act as a carrier. He preferred not to gas *via* a runner, because localized over-gassing, and consequent "burning," could occur at the joint of the mould cavity with the runner. A cellulose lacquer was used on patterns, and, where heavy wear occurred, two coats were employed. In putting blacking on a mould, a proprietary mix was used, so that the blacking stayed in suspension.

*$CO_2$ Process Discussions*

Trouble had been experienced in Mr. Talbot's foundry from the cracking of circular cores, arising from the distortion of the support rods, and to overcome this, one-piece circular rods were not now used, but part sections of a circular rod were overlapped instead. Cores could be well vented, and he suggested that this could prevent burn-on by rapidly removing hot air, and thus reducing temperature rise of the sand. He said that the fume resulting from $CO_2$ sand was less than that from oil sand, particularly if coal-dust was used as the $CO_2$-sand additive. He had experienced no metal/mould reaction when casting gunmetals and other non-ferrous alloys in $CO_2$-bonded sand. (Other founders report precautions are necessary with Al- and Mg-alloys.) He reported that a white coating was encountered on some moulds made by the $CO_2$ Process, but he believed this to be due to a sulphurous atmosphere. He found that metal contractions varied with different types of sand, and contraction allowances must be appropriately adjusted.

**Second Session**

The second session on the morning of March 22 was opened with Mr. S. H. Russell again occupying the chair. Then followed reports from representatives of a number of foundries who had experience of working the $CO_2$ Process, beginning with MR. G. B. TAYLOR (Ashmore, Benson, Pease & Company, Limited). Mr. Taylor said that his firm started using the $CO_2$ Process about 12 months ago and within eight months almost all their dry-sand work and core-sand work was being made in $CO_2$-bonded materials. They produced 4,200 tons of grey-iron castings per year, and were essentially a jobbing foundry. Various types of cast iron, including high-duty iron, were produced, and as a result the casting temperatures were often high.

At first a sea sand of low refractoriness, like their ordinary moulding sand, was employed. This gave trouble with poor break-down and poor surface finish, and was replaced by Congleton sand, which was better but too expensive; it had been necessary to revert to the local sand and establish a technique to enable them to use it. Mould dressings having an isopropyl-alcohol base were employed and they considered that neither this nor surplus $CO_2$ gas in the atmosphere represented a health hazard to employees. Used core sand was "dumped," but the moulding sand was returned to the system for use as green-sand facing or as a backing sand. Since using the $CO_2$ Process, the floor sand grew "white whiskers" and trouble with contamination was being experienced in the loam-sand moulding section. With $CO_2$ sand, burn-on and break-down problems were more troublesome than with ordinary moulding methods. The stripping times had been increased 20 per cent. and the firm paid more for their fettling. This latter operation was particularly troublesome on heavy-section castings, and the effect of poor ramming was readily evident.

In their own surface wash, the blacking settled from the isopropyl alcohol in about 2 min. so that it was necessary to stir the mix continuously. Hence, proprietary washes were adopted which were better but were still not completely satisfactory. Blacking of surfaces and hard ramming were important for success with the process.

For clean strip of a mould from a pattern, a cellulosed pattern was best. This, however, needed a flame-proof room for application, as was required by the factory inspectorate. On one occasion, a wooden pattern or core insert, alternatively, had been metallized for easier withdrawal. With some $CO_2$-bonded sand, "wash" defects had been experienced and, in one instance, $CO_2$ cores had again been replaced by oil-sand cores. At present, the Congleton sand had again in the $CO_2$-Process mix been replaced by sea sand, on account of cost. A core composition used sea sand with 3½ per cent. sodium silicate and 1 per cent. wood-flour. The wood-flour aided break-down, but tended to give a crumbly core. It was better to use wood-flour obtained from hard woods because it gave less moisture pick-up. This sand had the following properties:—Permeability (green) 150-170; (dry) 170-180; compressive strength (green) 1 lb. per sq. in.; (dry) 300 lb. per sq. in. In the moulding sand, 1 per cent. proprietary clay was added, otherwise the mix was the same.

The next contribution came from MR. R. PORTER (Newman, Hender & Company, Limited), who said he was making castings in bronze and grey iron using a mix of 50 per cent. Redhill H and 50 per cent. Southport sand $CO_2$ bonded. This gave a good finish and no mould coating was used. In making-up a mix, cold, dry sand was employed, and the mixed sand was stored in closed bins. One per cent. pelleted pitch could be used on jolt/squeeze machines and coreblowers. Parting powders were advantageous. While cores were being blown in one box, the gas could be injected in a second box so that no time was wasted. The coreblowing was carried out on a cartridge-type machine and when the $CO_2$ cores had to be stored, they were slightly under-gassed as made. The main attractions of the Process, Mr. Porter cited as the elimination of drying, sagging of cores and use of drying shells. No blacking of cores was carried on.

**Further Experiences**

MR. J. E. O. LITTLE (Glenfield & Kennedy, Limited) followed with particulars of his experience with $CO_2$ binders. Initially, trouble had been experienced because the Process was taken up too quickly. About a year ago, however, $CO_2$ sand was again used for general production-type work. When first introduced, core production was slowed down since time for gassing was required. Also black washing of cores gave problems, but good dimensional accuracy was achieved. For small cores, the Process was ideal and the girl operators preferred $CO_2$ sand. Large cores could be hollowed out, but gassing such cores gave problems in corners far removed from gassing points, since these tended to be under-gassed. No problems in core removal had been experienced. Complaints had arisen with $CO_2$ sand on account of fumes on

casting, but he considered that these were caused by the fact that the fumes would not ignite.

The base sand employed was a local sea sand which contained 4 per cent. clay and he had experienced difficulty in mixing the sand if the mill was not full, presumably due to incomplete admixture. So far as sand contamination was concerned, he had found that dry-sand moulds made from spent $CO_2$ sand gave trouble in knock-out. Such contamination had, however, now been stopped by separating dry-sand and $CO_2$-sand moulding. In using a $CO_2$ sand, a mould to be jolted needed a facing 3 to 4-in. thick of $CO_2$ sand, otherwise the machine tended to jolt the sand from the pattern face. The pattern was drawn "green."

The pattern coating found best was clear cellulose, applied in an open shed and often two coats of the varnish were needed. Suitable precautions would be required against the risk of fire. He considered it desirable to finish the mould in the "green" state and not to use rubbing. The time for gassing was controlled by means of an hour-glass made in the laboratory from two conical flasks. Gassing times varied with core size from 3 sec. to 1 min. He had tried mixing $CO_2$ with air for gassing and found that a 50:50 air:gas ratio was satisfactory.

Isopropyl-alcohol base blacking washes were used and in some cases this was applied to the "green" $CO_2$ sand. The alcohol then removed water from the bond. When this wash was subsequently fired it gave a hard surface skin to the sand, about $\frac{1}{8}$-in. thick, presumably due to water removal and gassing by combustion products. This treatment alone was satisfactory for drag parts of moulds but could not be used for top parts. Hence, in the practice now adopted, top parts only were gassed. In some cases, trouble from the black wash had occurred due to over-swabbing. This resulted in a concentration of shellac and black-wash which was not inflammable. Thus, if the mould was closed soon after burning off, the residue did not dry out and resulted in the moulds "blowing." Moulds were now sprayed with the blacking, but care was now necessary to ensure that sufficient was applied.

Higher pouring temperatures seemed desirable with $CO_2$ sand, but he was not quite definite on this point. The alloys cast were gunmetal, phosphor-bronze and nickel alloys. The $CO_2$ Process was very satisfactory in the firm's brass foundry. In some moulding techniques, $CO_2$ was introduced at the same time as the mould squeezing was done. The Process gave very-well-fitting cores and close dimensional accuracy and these were major attributes which were likely to be important.

MR. I. REES (Glanmor Foundry Company, Limited) was the next speaker. He said his firm was making plain carbon-steel and grey-iron castings in moulds produced by the $CO_2$ Process and extensive use was being made of core-assembly methods. If $CO_2$ hardening before stripping was employed, the Process was very dependent on having good pattern equipment. It was, however, possible to strip before gassing if a bentonite bond was employed in the sand mixture.

Castings in the 10-cwt. to 1-ton range were made with $CO_2$ facing sand with a backing of ordinary black sand. Above one ton, it was necessary to employ a complete mould of $CO_2$ sand, or else to use a backing of bricks with 3- to 6-in. layer of $CO_2$ sand facing; thus, the $CO_2$ sand acted as a sort of brick cement. Floor moulding methods were possible in $CO_2$ sand and strickle moulding was also used, although this needed a special technique.

Core-assembly methods were extensively employed for 5- to 10-ton castings, and this permitted rapid delivery of the castings. Several examples of castings made by core-assembly methods, using a minimum of pattern equipment, were shown by means of slides; with core-assembly methods and $CO_2$ sand, good accuracy was possible and no core rubbing was needed. Also, reduced fettling was entailed, while 25-ft. cores had been made without irons. However, $CO_2$ techniques made greater demands on the patternshop. Large cores could be bricked up at the centre and in this way a minimum of $CO_2$ sand was needed. If, however, difficulty in break-down at the knock-out was found with $CO_2$ sand, then the use of a conventional binder was still resorted to.

An example was shown of a 5-ton core used in a steel casting weighing 3 ton 13 cwt. Ashes were used at the centre. Mr. Rees said that they did not normally coat the surface of their $CO_2$ moulds or cores, and that thick sections and hot metal were desirable for the best strip. Another example showed a 3-ton 15-cwt. steel casting which embodied 48 cores; for this sand, 1 per cent. pitch was employed, but this was not often used for a steel casting. The largest casting made to date weighed 16 tons 13 cwt. Zircon sand was used at "hot spots" because of its better refractoriness.

Mr. Rees said that he obtained a remarkable strip with $CO_2$ sand, such as he had not seen before and thought that this was due to surface fusion of the sand. In steel castings, cores gave a hard adherence of sand where the core was in compression but showed no heavy burn-on. It was sometimes difficult to remove the sand from enclosed cores or from a re-entrant angle where the sand was in compression but once a core was broken into, it usually came out satisfactorily. Freedom from scabbing and buckling was better in $CO_2$ sand than ordinary sand. In some instances, however, he used a blacking paint, and on other occasions, he employed pitch.

(At this juncture, MR. R. L. HANDLEY, who was chairman of the Association's Information Committee which was largely responsible for organizing the conference, took over the chairmanship of the meeting.) The final speaker in this section devoted to practical adoption of the Process in foundries was MR. C. BLACKBURN of T. H. & J. Daniels, Limited. He said that his shop employed only seven moulders and they made both simple and complex cores by the $CO_2$ Process. A gassing pressure of 15 lb. per sq. in. was used and a spray blacking adopted. With the larger types of cores,

*$CO_2$ Process Discussions*

the core face was often gassed before the ashes were inserted. The normal practice was to ram up the facing and put in the backing with an impeller rammer. A proprietary compound was employed in the sand mix, to aid parting from the corebox. Large prints were well vented. One per cent. of a proprietary clay was used in the sand, and patterns with a deep draw could be moulded in a very satisfactory manner. The core sand used consisted of Erith silica sand with 1 per cent. pitch and 3½ per cent. binder and the moulding sand of 4 per cent. binder, 2 per cent. coal-dust and 0.2 per cent. parting compound. For moulding, clay was added to the same base sand. For aluminium castings, the amount of binder used was reduced, only 2 per cent. being used. It was better, he thought, to brush on blacking rather than to spray it.

### Testing $CO_2$-Process Sand

MR. D. A. TAYLOR (BCIRA) then gave a résumé of his experiences in adapting normal and special sand-testing procedures to assess $CO_2$ Process sands. Initially, he and his colleagues had got erratic results in their tests of sodium-silicate sand mixes. Later, they had used a straight sodium-silicate binder in three different viscosities, and employed a gassing rate of 200 ml. per sec.—lower than that used in industry. Also the pressure employed was lower than that used in industry, being 10 lb. instead of 20 lb. per sq. in. and the ratio of silica to sodium oxide was 3.5. The following conclusions were arrived at as a result of the series of tests so far completed:

(1) Over-gassing appeared to be dependent on the viscosity of the sodium-silicate employed.

(2) The as-gassed strength was proportional to the silicate content of the sand.

(3) Within limits, wet sand could be used for the $CO_2$ Process.

(4) Clay was found to have a pronounced effect, and 2 per cent. additions of this material reduced the "gassed-strength" to 25 per cent. of the value for a clay-free sand.

(5) Organic additions could be used in the sand to reduce the air-drying rate.

(6) Coal-dust and wood-flour additions reduced the gassed strength, and it was considered that knock-out properties were best when the sodium-silicate content was at a minimum.

(7) Gas-evolution rates from $CO_2$ sands were so low that little trouble need be expected from this cause.

(8) $CO_2$ sand could be reclaimed under certain conditions provided a water addition was made to compensate for any increase in the fine silica content of the sand.

### Comments

The afternoon was devoted to discussion of all the papers and the following salient points emerged:—

MR. RICE (British Non-Ferrous Metals Research Association) held that theoretically about 0.1 per cent. $CO_2$ by weight of the total mix was needed to harden it, if 4 per cent. binder was used. In practice, however, DR. ATTERTON said that about 1 per cent. by weight of $CO_2$ was commonly used. MR. TIPPER said that resins could be added to a $CO_2$ sand, and advantages might be obtained from the resulting gas evolution. Such resins should, however, not have a phenolic base and proprietary resins were now becoming available as addition materials.

DR. ATTERTON said that for strickle work, an addition of 0.25 per cent. plumbago might be made to a $CO_2$ sand.

MR. G. B. TAYLOR said that he had swept-up a mould in $CO_2$ sand and thought it would be satisfactory; however, increased fettling costs might have to be faced. As an alternative to normal strickling with $CO_2$ sand, MR. REES said that a secondary pattern might be made, rammed up, the part gassed, and the pattern moved on around a central spindle. A member said that a silica to sodium-oxide ratio of 3.5 was, in practice, not the best, and that Mr. Taylor should have used a ratio of 2.0.

It was suggested that plumbago might be used as a pattern coating but MR. TALBOT said that he did not favour this idea in his own foundry, though he did not rule out entirely the possibility of its success. MR. SNELSON said that in $CO_2$ sand, different contraction allowances from those used in conventional sand-moulding practice should be used. In steel, for big sections, contraction allowances of 1 in 48 should be made, while for castings with thin and complex cores the allowance should be 1 in 64. For freely-contracting grey-iron, a contraction rule of 1 in 120 should be used, while a high-duty iron required 1 in 80. MR. TIPPER said that oil additions to the $CO_2$ sand gave a gas which might inhibit burn-on.

## Recent Wills

MYCOE, ALBERT, traffic manager to the Metropolitan-Vickers Electrical Company, Limited ... ... £13,409

HOMBERGER, DR. E. J., chairman of the Britannia Iron & Steel Works, Limited, Bedford ... ... £1,473

PATERSON, ROBERT, chairman of Park & Paterson, Limited, metal merchants, of Parkhead, Glasgow £33,713

TROWBRIDGE, G. C., formerly managing director of Wickman, Limited, machine-tool manufacturers, of Coventry ... ... ... ... ... ... ... £21,607

SPENCER, JOHN, late senior joint managing director of William Towler & Company, Limited, steel and iron founders, of Leeds ... ... ... ... ... £10,497

MERCER, E. B. R., formerly a director and secretary of Manley & Regulus, Limited, brassfounders, etc., of Wolverhampton ... ... ... ... ... £15,017

SWALES, E. W., deputy managing director of the Lockheed Hydraulic Brake Company, Limited, Leamington Spa, and joint deputy managing director of the Automotive Products Company, Limited, also of Leamington Spa ... ... ... £47,355

# BIF Briefs

The British Industries Fair which is to be held simultaneously at Castle Bromwich, Birmingham, and Olympia, London, from April 23 to May 4, will be open to trade buyers from 9.30 a.m. to 6 p.m. daily, and to the general public from 2 p.m. and all day Saturday, April 28, but closes on the final day (May 4) at 4 p.m. At Castle Bromwich, engineering, building, heating, electrical, industrial and factory equipment, and hardware will be featured and below is a selection of brief descriptions of stands at this section which it is considered will be of major interest to foundrymen, with emphasis on supplies, plant, and equipment which is novel or being shown for the first time:—

ENGLISH STEEL TOOL CORPORATION, LIMITED, Openshaw, Manchester, will be participating in the composite stand organized by the Gauge and Toolmakers' Association (stand No. C.321/220) and will be displaying a comprehensive selection of engineers' cutting tools, including files and hacksaw blades.

A NEW EXHIBITOR at the Fair is M.E.O., Limited, of 251, Brompton Road, London, S.W.3, whose stand (No. D.351) will be devoted to a range of Rotolift lifting and pulling tools. The tools are available in three capacities—¼, 1½, and 3 tons—and incorporate a self-sustaining brake which enables very accurate lowering and raising to be carried out.

IN ADDITION to a selection of standard motor-starters and oil-break switchgear, Allen West & Company, Limited, Brighton, will be featuring crane-control equipment on stand No. A.41/51. This will include a working hoist controlled by d.c. injection, which will be operated by a new control unit comprising a grouped driver's seat and master controllers.

AMONG THE EXHIBITS of Henry Wiggin & Company, Limited, Birmingham, (stand No. B.4), will be the Nimonic series of nickel/chromium-base alloys developed specially for use at high temperatures. They will be represented by a Rover-Rotax 1S/60 gas-turbine 40-kva. generator, and by employment of the alloys in electric-furnace conveyor-belting and element-securing pins.

INDUSTRIAL SPRAY-GUNS, stationary and portable, air compressors, pressure-feed tanks and other auxiliary equipment which will be featured on stand No. D.405/304 of the Aerograph Company, Limited, will include a paint heater of entirely new design for the hot-spray method of paint application, and an automatic transverse spray-coating machine capable of dealing with the mass production of articles up to 6,000 per hour.

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY'S exhibit, covering an area of about 8,000 sq. ft., embraces many peaceful applications of atomic energy in industry, and will be the biggest display of its kind to be given in this country. Among associated reactor instruments which will be on show, forming part of a reactor control room, is a health monitor to indicate the prevailing gamma-radiation level in the working area around the pile.

A FULL RANGE of 31 different types of Sifbronze oxy-acetylene welding rods and their appropriate fluxes, together with light- and general-duty blowpipes and regulators, will be on view on the stand of the Suffolk Iron Foundry (1920), Limited, Stowmarket, Suffolk (No. D.620). The exhibit includes a new product—the Demon cutting blowpipe, which is supplied with two cutting nozzles and will cut metal up to 10-in. thick.

HALE & HALE (TIPTON), LIMITED, Tipton, Staffs, will as usual feature on their stand (No. D.609/508) a representative selection of malleable-iron castings which they produce for a wide range of industries including the car and heavy commercial vehicle industry, agricultural trades, electrical, railway and building. Their patent shipbuilding wedge will be included in the exhibit as also will be the Barslide head for use in connection with hydraulic pit props.

CASTINGS in 16 of the Paralloy range of stainless steels will be featured by A.P.V.-Paramount, Limited, on stand No. C.732. They include general-purpose and special-purpose corrosion-resistant steels, free-machining varieties and heat-resisting castings. Exhibits will carry the nominal alloy specification and type uses will be indicated. The company will also illustrate some of their casting services, including the $CO_2$-moulding technique, shell moulding and radiographic examination.

EXAMPLES of their range of magnetic extractors, swarf separators, and magnetic clutches and brakes will be exhibited by Rapid Magnetic Machines, Limited, Birmingham (stand No. C.421). New units include a rotary extractor with diverter scroll, and the Ejecta plate magnet. A novel device, the Permalift, recently introduced to help solve the problem of container handling; the tramp-iron diverter unit, which is approximately four times as powerful as the similar size of drum or pulley, and the portable foundry separator will also be available for inspection.

ALFRED BULLOWS & SONS, LIMITED, Walsall (stand D.743/642), are to display a complete range of stationary and portable Hydrovane compressors both petrol-engine and electrically driven, with a capacity ranging from 3 to 250 cub. ft. per min. per unit. The firm's PR.303E spray painting plant will be demonstrated; and a 2-gall. pressure paint container of new design and construction will be included in the range of Bullows spray guns and spraying equipment. Among working models will be a water-wash spray booth, pressure containers, air motors, reducing valves, and filters and fluid regulators.

TO DISPLAY A SELECTION of their range of tractors and battery-powered industrial trucks, Ransomes Sims & Jefferies, Limited, Orwell Works, Ipswich, will occupy indoor stand No. A.502 and outdoor stands Nos. 1317 and 1216. Trucks include: The Forklift 10—normal load capacity 1,120 lb. at 15-in. centre and equipped with an overhead load stabilizer; Model 2000, equipped with Hydrum load clamp for handling bales, bins, etc., and Model 40, which with a paper reel clamp is suitable for transporting and stacking paper reels, barrels or similarly shaped commodities; and the ENU 8 elevating platform truck. Two types of tractor, the TE and the T4, will also be on show.

THE OWEN ORGANIZATION will be well represented by the several member companies, in both the engineering and building sections (stands No. D.616/717 and D.730 in the former and B.522 in the latter). An exhibit of special interest to foundrymen will be the model, on stand D.616/717, of the recently developed Hallsworth automatic moulding system—details of which will be published shortly in the JOURNAL. Other exhibits include pallets of all types for material handling; a specially manoeuvrable battery-electric fork truck; a selection of non-ferrous sand castings; aluminium-alloy gravity-die-castings, shell-moulded castings and chill-cast phosphor-bronze bars.

EXHIBITS on stand No. D.641/540 of the Department of Scientific and Industrial Research, will demonstrate the application of research to the development

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of products in the following fields: Titanium production; niobium-tube and -sheet production; bearings in aluminium/tin alloys; and hardened anodized surfaces for aluminium. A test-rig of a tractor equipped with a hydrostatic drive in which the engines are located in the wheels will be on show together with a high-speed grinding spindle with hydraulic drive and bearings which can operate at speeds up to 148,000 r.p.m. and an air-operated saw which operates on compressed air supplied by a small standard compressor.

KEITH BLACKMAN, LIMITED, Tottenham, London, N.17 (stand No. D.726), will display fume-removal fans with p.v.c. (poly-vinyl-chloride) casings and impellers, as well as their standard fans. Another principal exhibit comprises a selection of industrial gas-apparatus, for example a B4-size air and gas-mixture unit complete with compressor, gas governor, back pressure valves, interconnection piping and with a Plymat filter fitted to the inlet. This unit ensures the accurate mixing of air and gas to specified ratios as necessary in various industrial processes. In furnace work, for example, it provides an oxidizing or reducing mixture as required, at pressures up to 40-in. w.g. and overcomes resistance created by other apparatus in the circuit.

**Olympia Section**

At Olympia the exhibits will include chemicals, electrical household appliances, electrical and electronic plant and equipment, office appliances and scientific instruments. The following few paragraphs concern exhibits of major interest to foundrymen:—

CARBON DIOXIDE COMPANY, LIMITED, a branch of the Distillers Company, Limited, will feature applications of $CO_2$ in the foundry and engineering industries on stand No. C.26/32.

AMONG the main British Thomson-Houston exhibits on stand No. A.64/A.69 (Grand Hall) will be marine radar-equipment; switchgear; germanium and silicon power-rectifiers; electric motors, including fractional horsepower sizes; industrial electronic equipment; and lamps and lighting equipment.

IT IS SOMEWHAT unusual to find Fullers' Earth Union, Limited, exhibiting at Olympia this year, instead of Birmingham. They are including demonstrations of Fulbond, a clay for use in iron and non-ferrous foundries, on stand No. C.20/C.39. Efficient gelling and suspending grades of fullers' earth will also be featured and a wide range of special products for applications in the absorbent, catalytic and ion-exchange fields.

THE GENERAL ELECTRIC COMPANY, LIMITED, who are exhibiting for the first time at the Olympia section of the B.I.F., will feature on stands A.61/A.72 (Grand Hall) modern power equipment, and domestic equipment and household appliances. The power equipment section will include a complete low-pressure rotor assembly for a 60,000-kw. steam-turbine, approx. 14-ft. long by 8-ft. dia. and weighing nearly 15 tons; a small rotor of the type used in a 325-kw. marine auxiliary turbo-generating set; and a 200-h.p. electric train-motor, similar to those supplied to the British Transport Commisison for the Southend electrification scheme.

APPROXIMATELY 120 of Britain's leading chemical manufacturers will be represented in the chemical section, covering almost every phase of modern chemical production, from the heavy chemicals (acids and alkalis) to the latest products of chemical research such as plastics, pharmaceuticals, silicones and synthetic fibres. Of particular interest to foundrymen will be the stand of the Midland Tar Distillers, Limited, Oldbury, near Birmingham, who will be exhibiting an illuminated flow sheet indicating the primary and secondary derivatives of coal-tar distillation. Samples of coal-tar products with indications of their uses will include pelleted pitch for foundry sand bonding.

## *Company News*

CLARKE, CHAPMAN & COMPANY, LIMITED, marine and electrical engineers, boilermakers, etc., of Gateshead—On the £720,000 ordinary capital a dividend of 22½ per cent. is being paid for 1955, against 20 per cent. in the previous year.

WARNER & COMPANY, LIMITED, makers of refined pig-iron, of Cargo Fleet, Middlesbrough—The directors announce a one-for-one scrip issue to holders of March 1. The new ordinary shares will rank for all dividends declared after the date of allotment.

PROJECTILE & ENGINEERING COMPANY, LIMITED—A final dividend of 7½ per cent. by the company makes a 10 per cent. total for 1955 on £600,000 ordinary, an equivalent decrease of 5 per cent. compared with 1954. Trading profits declined from £249,220 to £141,459 and the net profit, after tax, from £117,835 to £74,264.

G. D. PETERS & COMPANY, LIMITED, rolling-stock manufacturers, etc., of Slough (Bucks)—Although the company experienced a difficult year in 1955, two fires causing a severe setback, the dividend is raised by 1 per cent., with a recommended final dividend of 3½ per cent., making 6 per cent., against 5 per cent. in 1954.

ALFRED HERBERT, LIMITED—A repeated final dividend of 3½ per cent., tax free, to make an unchanged total of 6 per cent., tax free, on the £5,461,875 ordinary capital for the year to October 31, 1955, is recommended by the board. In addition, a special capital payment, not subject to tax, of one third of 1 per cent. is announced.

TATA IRON & STEEL COMPANY, LIMITED—Shareholders have empowered the directors to increase the capital from 17,38,75,000 to 27,02,50,000 rupees by issuing new ordinary shares. The new funds will be used for the planned expansion of production capacity to 2,000,000 tons of steel annually, scheduled for completion in 20 months' time.

SWAN, HUNTER, & WIGHAM RICHARDSON, LIMITED—A final dividend of 11 per cent. on the £3,422,128 ordinary capital, to make a total of 14 per cent. for 1955, is recommended by the board. In 1954 a final of 10 per cent. was paid on the present capital, but the 4 per cent. interim was on £1,711,064 before the 100 per cent. scrip issue, making 12 per cent. equivalent.

VACTRIC, LIMITED, electrical and mechanical engineers, of London, W.1—The directors announce scrip issues of four new 5s. "A" (non-voting) ordinary shares and one 6 per cent. £1 cumulative preference share for every eight ordinary shares held on March 16. The "A" ordinary will rank for the current year's dividend, and the preference as from March 31.

MATHER & PLATT, LIMITED, general engineers, of Manchester—The company is repeating 15 per cent. for 1955 on £3,409,150 ordinary stock with the recommendation of a final dividend of 6 per cent. and bonus of 5 per cent. The 4 per cent. interim on account of 1954, however, was paid on £2,045,490, before a 66⅔ per cent. scrip issue and consequently the 1955 distribution represents an effective increase of 1 per cent. The consolidated trading profit is down from £1,821,757 to £1,764,603.

# Imports and Exports of Iron and Steel in November

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in November. Totals for the first eleven months of 1955 and 1954 are also included.

## *Exports of Iron and Steel*

| Destination. | Month ended Nov. 30. | Eleven months ended November 30. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Channel Islands | 535 | 4,632 | 5,578 |
| Cyprus | 264 | 6,576 | 3,967 |
| Sierra Leone | 1,087 | 9,194 | 7,971 |
| Gold Coast | 1,723 | 30,314 | 21,381 |
| Nigeria | 5,064 | 53,042 | 44,383 |
| Union of South Africa | 4,263 | 48,755 | 60,953 |
| Rhodesia and Nyasaland | 6,030 | 54,785 | 61,283 |
| Tanganyika | 2,127 | 19,248 | 15,908 |
| Kenya | 2,308 | 62,433 | 42,180 |
| Uganda | 384 | 5,656 | 4,170 |
| Mauritius | 223 | 4,595 | 2,219 |
| Bahrain, Qatar, and Trucial Oman | 1,825 | 18,080 | 11,189 |
| Kuwait | 924 | 5,093 | 4,409 |
| India | 24,467 | 84,300 | 138,432 |
| Pakistan | 2,301 | 59,926 | 36,443 |
| Singapore | 2,811 | 24,561 | 32,741 |
| Malaya | 2,310 | 19,851 | 22,624 |
| Ceylon | 1,332 | 17,592 | 15,679 |
| British North Borneo | 368 | 3,438 | 4,080 |
| Hongkong | 2,664 | 25,339 | 40,451 |
| Australia | 27,557 | 290,883 | 355,560 |
| New Zealand | 18,607 | 184,886 | 236,706 |
| Canada | 15,014 | 150,015 | 119,523 |
| Jamaica | 2,262 | 13,665 | 15,852 |
| Trinidad | 4,793 | 35,240 | 42,676 |
| British Guiana | 443 | 4,473 | 6,912 |
| Anglo-Egyptian Sudan | 1,011 | 28,703 | 15,977 |
| Other Commonwealth countries | 2,531 | 20,586 | 29,153 |
| Eire | 4,871 | 46,098 | 53,737 |
| Finland | 4,823 | 65,672 | 65,208 |
| Sweden | 14,768 | 69,634 | 127,234 |
| Norway | 9,096 | 72,126 | 98,680 |
| Denmark | 6,073 | 74,222 | 70,839 |
| Western Germany | 1,453 | 17,802 | 10,545 |
| Netherlands | 9,213 | 88,513 | 88,976 |
| Belgium | 1,676 | 10,523 | 19,590 |
| France | 461 | 4,269 | 5,179 |
| Switzerland | 936 | 10,236 | 13,301 |
| Portugal | 518 | 10,928 | 12,117 |
| Spain | 1,397 | 6,789 | 56,248 |
| Italy | 2,139 | 37,103 | 23,858 |
| Austria | 212 | 1,656 | 2,877 |
| Yugoslabia | 1,065 | 13,483 | 12,601 |
| Turkey | 354 | 8,020 | 7,425 |
| Netherlands Antilles | 806 | 3,042 | 10,428 |
| Portuguese E. Africa | 711 | 2,222 | 2,465 |
| Lebanon | 1,332 | 1,965 | 17,390 |
| Israel | 1,953 | 6,639 | 10,706 |
| Egypt | 1,160 | 21,583 | 19,785 |
| Saudi Arabia | 12 | 4,638 | 5,946 |
| Iraq | 3,151 | 22,954 | 39,230 |
| Iran | 5,920 | 9,441 | 67,568 |
| Burma | 834 | 10,094 | 9,729 |
| Thailand | 413 | 7,554 | 4,567 |
| Indonesia | 1,617 | 4,904 | 4,752 |
| Philippine Republic | 713 | 3,316 | 7,753 |
| USA | 3,631 | 38,514 | 47,258 |
| Colombia | 53 | 7,907 | 5,010 |
| Venezuela | 6,318 | 28,640 | 58,007 |
| Ecuador | 569 | 2,494 | 3,408 |
| Peru | 1,174 | 4,778 | 9,476 |
| Chile | 117 | 1,240 | 882 |
| Uruguay | 171 | 12,689 | 6,118 |
| Argentina | 2,703 | 53,433 | 47,612 |
| Other foreign countries | 4,161 | 59,088 | 44,572 |
| TOTAL | 231,812 | 2,129,069 | 2,489,477 |

## *Total Imports of Iron and Steel*

| From | Month ended Nov. 30. | Eleven months ended November 30. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Australia | 5 | 21,668 | 67 |
| Canada | 7,579 | 9,963 | 118,372 |
| Other Commonwealth countries and Eire | 1,299 | 5,207 | 26,775 |
| Soviet Union | 28,582 | 112,452 | 200,519 |
| Sweden | 3,777 | 32,532 | 29,705 |
| Norway | 9,899 | 30,219 | 78,553 |
| Western Germany | 13,892 | 41,877 | 68,258 |
| Netherlands | 12,706 | 86,272 | 149,104 |
| Belgium | 26,071 | 36,881 | 187,658 |
| Luxembourg | 9,289 | 16,171 | 44,384 |
| France | 46,748 | 57,776 | 270,546 |
| Italy | 25 | 7,483 | 1,894 |
| Austria | 13,406 | 152,988 | 115,401 |
| Japan | 1,212 | 484 | 27,543 |
| USA | 58,832 | 81,914 | 697,825 |
| Other foreign countries | 13,581 | 3,913 | 35,332 |
| TOTAL | 246,903 | 697,800 | 2,051,936 |
| Iron and steel scrap and waste, fit only for the recovery of metal | 133,445 | 714,982 | 1,174,954 |

## *Exports of Iron and Steel, by Product*

| Product. | Month ended Nov. 30. | Eleven months ended November 30. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Pig-iron | 4,284 | 33,500 | 45,284 |
| Ferro-columbium (niobium)* | 6 | — | 55 |
| Ferro-tungsten | 45 | 391 | 561 |
| Other ferro-alloys† | 329 | 9,742 | 3,111 |
| Ingots, blooms, billets, slabs, sheet, and tinplate bars | 119 | 1,971 | 3,685 |
| Iron bars, rods, angles, shapes, and sections | 414 | 2,501 | 3,172 |
| Steel bars, rods, angles, sections, and shapes | 40,011 | 332,474 | 401,647 |
| Iron plates and sheets | 13 | 236 | 151 |
| Universal plates | 526 | 4,301 | 8,452 |
| Steel plates ⅛ in. and under ¼ in. | 1,633 | 14,314 | 17,739 |
| Do., ¼ in. and over | 24,727 | 149,200 | 241,106 |
| Black sheets and black plate | 22,266 | 175,011 | 203,766 |
| Hoop and strip | 7,065 | 95,328 | 94,418 |
| Tinplate | 21,774 | 276,904 | 288,812 |
| Tinned sheets, terneplate, and ternesheets | 257 | 2,141 | 2,635 |
| Decorated tinplate | 431 | 2,665 | 4,179 |
| Galvanized sheets | 10,902 | 156,097 | 149,960 |
| Other coated plates and sheets | 827 | 7,047 | 10,049 |
| Railway and tramway construction material | 23,739 | 212,200 | 251,777 |
| Wire rods | 2,125 | 25,483 | 27,626 |
| Wire | 8,584 | 82,584 | 90,540 |
| Tubes, pipes, and fittings | 61,081 | 527,721 | 627,537 |
| Iron castings | 223 | 11,404 | 8,707 |
| Steel castings | 192 | 1,642 | 1,660 |
| Forgings | 269 | 4,212 | 2,848 |
| TOTAL | 231,812 | 2,129,069 | 2,489,477 |

* Not separately distinguished before 1955.
† The figures for 1955 are not completely comparable with those for previous years.

RECENTLY at the electric department of the C'ay Cross Company, Limited, Chesterfield, presentations were made to Mr. W. R. Ferguson, chief electrical engineer, who retired at the beginning of the year after 40 years with the company, and Mr. H. J. Stoppard, a maintenance engineer with 45 years' service.

"GAS TEMPERATURE MEASUREMENT" is the title of a paper to be read at a conference to be held in Dusseldorf on April 19 and 20, by Mr. R. Barber of Land Pyrometers, Limited, Sheffield.

# Imports and Exports of Iron and Steel in December

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in December, 1955. Totals for 1955 and the previous year are also included.

## *Exports of Iron and Steel*

| Destination. | Month ended Dec. 31. | Twelve months ended December 31. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Channel Islands | 461 | 5,173 | 6,038 |
| Cyprus | 557 | 7,000 | 4,524 |
| Sierra Leone | 1,043 | 9,910 | 9,014 |
| Gold Coast | 1,498 | 31,957 | 22,929 |
| Nigeria | 5,452 | 58,797 | 49,815 |
| Union of South Africa | 4,612 | 54,420 | 65,563 |
| Rhodesia and Nyasaland | 2,911 | 61,427 | 64,158 |
| Tanganyika | 1,443 | 19,498 | 17,302 |
| Kenya | 3,812 | 66,297 | 46,089 |
| Uganda | 439 | 5,817 | 4,609 |
| Mauritius | 157 | 4,668 | 2,376 |
| Bahrain, Qatar, and Trucial Oman | 1,081 | 19,540 | 12,235 |
| Kuwait | 132 | 5,543 | 4,541 |
| India | 25,006 | 93,704 | 163,717 |
| Pakistan | 4,176 | 67,555 | 40,703 |
| Singapore | 4,763 | 25,933 | 37,485 |
| Malaya | 3,312 | 20,919 | 25,885 |
| Ceylon | 2,503 | 19,372 | 18,081 |
| British North Borneo | 168 | 3,879 | 4,248 |
| Hongkong | 4,140 | 28,004 | 44,591 |
| Australia | 27,676 | 331,649 | 383,130 |
| New Zealand | 20,784 | 198,772 | 257,449 |
| Canada | 13,572 | 157,731 | 133,035 |
| Jamaica | 1,275 | 14,649 | 17,132 |
| Trinidad | 3,924 | 38,929 | 46,595 |
| British Guiana | 600 | 4,657 | 7,512 |
| Anglo-Egyptian Sudan | 2,021 | 30,310 | 17,991 |
| Other Commonwealth countries | 2,951 | 24,124 | 32,087 |
| Eire | 5,043 | 50,358 | 58,757 |
| Finland | 4,079 | 73,831 | 69,194 |
| Sweden | 9,780 | 81,914 | 137,004 |
| Norway | 5,826 | 80,522 | 104,494 |
| Denmark | 3,802 | 82,571 | 74,640 |
| Western Germany | 1,390 | 21,333 | 12,048 |
| Netherlands | 9,547 | 100,488 | 98,535 |
| Belgium | 1,898 | 12,679 | 21,487 |
| France | 632 | 4,464 | 5,811 |
| Switzerland | 1,288 | 11,541 | 14,590 |
| Portugal | 643 | 12,039 | 12,760 |
| Spain | 906 | 7,120 | 57,128 |
| Italy | 2,591 | 38,201 | 26,449 |
| Austria | 423 | 2,267 | 3,300 |
| Yugoslavia | 2,498 | 14,040 | 15,099 |
| Turkey | 835 | 8,884 | 8,260 |
| Netherlands Antilles | 611 | 3,560 | 11,039 |
| Portuguese E. Africa | 905 | 2,453 | 3,370 |
| Lebanon | 60 | 2,059 | 17,450 |
| Israel | 1,518 | 7,156 | 12,229 |
| Egypt | 2,547 | 24,058 | 22,305 |
| Saudi Arabia | 920 | 4,741 | 6,866 |
| Iraq | 1,754 | 24,265 | 40,863 |
| Iran | 17,509 | 12,881 | 85,077 |
| Burma | 555 | 11,986 | 10,138 |
| Thailand | 469 | 7,806 | 5,046 |
| Indonesia | 542 | 5,301 | 5,294 |
| Philippine Republic | 629 | 3,393 | 8,394 |
| USA | 4,086 | 44,581 | 51,368 |
| Columbia | 16 | 8,474 | 5,026 |
| Venezuela | 4,251 | 34,403 | 62,258 |
| Ecuador | 513 | 2,912 | 3,921 |
| Peru | 967 | 5,063 | 10,443 |
| Chile | 105 | 1,497 | 987 |
| Uruguay | 684 | 14,255 | 6,802 |
| Argentina | 5,312 | 55,983 | 52,925 |
| Other foreign countries | 3,084 | 64,433 | 47,654 |
| TOTAL | 238,687 | 2,352,746 | 2,727,845 |

## *Total Imports of Iron and Steel*

| From | Month ended Dec. 31. | Twelve months ended December 31. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Australia | 12 | 21,679 | 79 |
| Canada | 6,094 | 13,629 | 124,020 |
| Other Commonwealth countries and Eire | 1,632 | 5,433 | 28,406 |
| Soviet Union | 63,271 | 119,825 | 263,789 |
| Sweden | 3,515 | 34,807 | 33,220 |
| Norway | 4,083 | 37,253 | 82,636 |
| Western Germany | 14,933 | 42,758 | 83,213 |
| Netherlands | 19,743 | 90,583 | 169,193 |
| Belgium | 25,217 | 43,176 | 212,538 |
| Luxembourg | 7,637 | 19,019 | 52,088 |
| France | 43,240 | 66,000 | 313,918 |
| Italy | 917 | 7,527 | 2,811 |
| Austria | 14,165 | 161,878 | 129,566 |
| Japan | 9,092 | 495 | 36,635 |
| USA | 50,876 | 93,529 | 748,277 |
| Other foreign countries | 5,970 | 6,182 | 40,939 |
| TOTAL | 270,397 | 763,773 | 2,321,328 |
| Iron and steel scrap and waste, fit only for the recovery of metal | 103,116 | 759,632 | 1,277,391 |

## *Exports of Iron and Steel, by Product*

| Product. | Month ended Dec. 31. | Twelve months ended December 30. | |
|---|---|---|---|
| | 1955. | 1954. | 1955. |
| | Tons. | Tons. | Tons. |
| Pig-iron | 5,689 | 43,748 | 51,018 |
| Ferro-colombium (niobium)* | 11 | — | 66 |
| Ferro-tungsten | 41 | 398 | 592 |
| Other ferro-alloys† | 407 | 10,698 | 3,520 |
| Ingots, blooms, billets, slabs, sheet, and tinplate bars | 217 | 2,864 | 3,781 |
| Iron bars, rods, angles, shapes, and sections | 404 | 2,606 | 3,544 |
| Steel bars, rods, angles, sections, and shapes | 34,510 | 372,678 | 436,271 |
| Iron plates and sheets | 80 | 246 | 208 |
| Universal plates | 2,766 | 4,293 | 11,231 |
| Steel plates, ¼ in. and under ⅜ in. | 1,405 | 14,918 | 19,210 |
| Do., ⅜ in. and over | 23,500 | 174,829 | 264,535 |
| Black sheets and black plate | 23,322 | 192,533 | 227,260 |
| Hoop and strip | 6,571 | 105,837 | 101,007 |
| Tinplate | 25,329 | 297,307 | 314,141 |
| Tinned sheets, terneplate, and ternesheets | 186 | 2,357 | 2,805 |
| Decorated tinplate | 429 | 3,073 | 4,455 |
| Galvanized sheets | 13,140 | 168,539 | 162,965 |
| Other coated plates and sheets | 756 | 7,831 | 10,649 |
| Railway and tramway construction material | 31,749 | 229,538 | 283,643 |
| Wire rods | 2,208 | 28,041 | 29,827 |
| Wire | 7,922 | 90,923 | 98,559 |
| Tubes, pipes, and fittings | 55,995 | 581,629 | 683,304 |
| Iron castings | 1,575 | 11,514 | 10,277 |
| Steel castings | 132 | 1,730 | 1,785 |
| Forgings | 343 | 4,616 | 3,192 |
| TOTAL | 238,687 | 2,352,746 | 2,727,845 |

* Not separately distinguished before 1955.
† The figures for 1955 are not completely comparable with those for previous years.

SCOTTISH MOTOR TRACTION COMPANY, LIMITED, have offered to purchase the whole of the issued share capital of Alex. Findlay & Company, Limited, constructional engineers, Motherwell. The directors of the latter company have accepted the offer in respect of their own shareholdings and will recommend other shareholders to accept. The sum involved in the transaction is about £650,000.

BURTON GRIFFITHS & COMPANY, LIMITED, Sparkbrook, Birmingham, have made arrangements with Robert Bosch A.G., Stuttgart, Germany, for their mobile demonstration and servicing unit to tour various areas in the UK, to introduce the range of high-frequency electric hand-tools—grinders sanders and drilling machines—which they are handling.

# News in Brief

THE NEXT of the courses run for welding operators, supervisors, and inspectors by Quasi-Arc, Limited, Bilston (Staffs), will commence on June 11. There will be a further course starting August 27.

MR. RAYMOND MCKIE, secretary and director of Hopkinson's, Limited, valve manufacturers, Britannia Works, Huddersfield, has been installed as president of Huddersfield Chamber of Commerce.

DURING their tour of Northern industrial centres Service chiefs from the Imperial Defence College visited, on April 13, the Tractor Works of David Brown Industries, Limited, at Meltham, near Huddersfield.

AT THE APRIL MEETING of the Non-Ferrous Club at which Mr. Jack Hargreaves was the guest, a collection for charity realized £16 16s 0d., this being on behalf of the National Society for the Prevention of Cruelty to Children.

THE electronics section of the Scientific Instrument Manufacturers' Association are organizing an exhibition entitled "Atoms, Electrons and Industry," to take place at the Royal West of England Academy, Bristol, from June 6 to 8.

CHAMBERLAIN INDUSTRIES, LIMITED, of Staffa Road, Leyton, London, E.10, announce that they have been appointed sole agents in England for the Jenbach compressor, a single-stage diesel model, which is manufactured in Austria.

SHALLWAY CORPORATION, Ninth and West Crawford, Connellsville, Pennsylvania, announce the appointment of Mr. Charles Lay, formerly vice-president of Upstate Metal Casting Company of Norwich, N.Y., as their shell-moulding equipment service manager.

MR. IAIN MACLEOD, Minister of Labour and National Service, will open the 1956 Production Exhibition to be held at Olympia from May 23 to 31. Sir Leonard Lord, K.B.E., president of the Institution of Production Engineers, will be president of the exhibition.

THE MIDDLE of next year has been announced in the Indian Parliament as the date by which the new aluminium-producing factory at Hirakud will be working. With an annual output of 10,000,000 tons, the new factory will double India's aluminium production.

BELARK TOOL & STAMPING COMPANY, LIMITED, announce that Mr. M. Elston and Mr. F. B. Quinn will be in Birmingham at the Imperial Hotel on May 15 and 16 between 9.30 a.m. and 7 p.m. to give demonstrations of the Belark aluminium soldering tool and to show some of the work done with the tool.

AN £842,875 order for coal-handling plant at Blyth "A" power station has been placed by the Central Electricity Authority with the Birtley Company, Limited. The plant will be completed and ready for use by April, 1958. The Birtley Company recently built a coal-handling plant at Stella North power station.

READINESS to build nuclear power stations in Canada has been announced by the Mitchell Engineering, Limited, group, and its Canadian subsidiary. According to Mr. Roy H. Foss, vice-president of the Canadian company, design and construction of reactors and mechanical equipment will be carried out by the British parent company.

THE INSTITUTION OF PRODUCTION ENGINEERS announces that the forthcoming North Western Regional Lecture will be given by Sir George Barnett, H.M. Chief Inspector of Factories, on April 23, at the Manchester College of Science and Technology, at 6.30 p.m. His subject will be the "Factory Acts and How they Affect Engineering Establishments."

TWO STEELWORKERS who were lighting a gas furnace after the Easter holidays were injured in an explosion at the River Don works of the English Steel Corporation, Limited, Sheffield. One was burned about the face and arms and was admitted to Sheffield Royal Infirmary, while the other, who only received burns to his face, was allowed to go home after treatment.

COSELEY ENGINEERING, LIMITED, Wolverhampton, have secured a one-million-dollar contract to supply prefabricated aircraft hangars to the Royal Canadian Air Force. The order, believed to be the largest placed in this country from North America for prefabricated buildings, will make the firm's business in Canada this year total nearly three million dollars.

THE first International Congress of Surface Activity was held in Paris in 1954. The second congress will be held in London from April 8 to 12, 1957, with Lord Brabazon of Tara as the president of honour and Professor Sir Eric Rideal as the president. Details are available from the honorary secretary, 2nd International Congress of Surface Activity, 14, Belgrave Square, London, S.W.1.

FOR the United States Steel Corporation, 1955 was a record year as regards sales, income, wages, and dividends. During the year the Corporation's sales reached $4,097,700,000, earnings $370,100,000 and deliveries 25,500,000 tons. Average earnings of the Corporation's 273,000 employees, exclusive of social security taxes and of employee benefits, were $2.70 an hour or $101 (£36) a week.

THE Asquith Machine Tool Corporation, Limited, has concluded an agreement with the French company, Batignolles-Chatillon, for the exclusive manufacturing rights in England of the "Pilote" automatic-cycle-copying lathe. Asquith Tool has also obtained the exclusive selling rights in England and the greater part of the Commonwealth for this type of lathe, as from November 1, 1957.

FORTYFIVE foremen left London on April 14 for a fortnight's visit to Germany, organized by the Industrial Welfare Society. They are to spend a whole day at each of seven different firms in various parts of Germany, and are to see factories making a wide range of products. At each works they are to have discussions with managers and foremen, members of works committees and joint production committees.

IT IS ANTICIPATED that Falls Foundry, the Belfast branch of the Wellman Smith Owen Engineering Corporation, Limited, will "benefit considerably" from the £80,000,000 Indian steelworks order placed with a group of British firms. The Corporation is one of the four steelworks' plant manufacturers that will be responsible for various sections of the iron and steel plant to be constructed at Durgapur, in West Bengal.

WOLVERHAMPTON DIECASTING COMPANY, LIMITED, and Wilmot Breeden, Limited, have announced that they have decided not to proceed with the projects for adjacent factories at Bloxwich, Walsall, launched early last year. An official statement issued in the names of both companies states that "instead, the developments visualized in these arrangements will be attained at their individual factories, which have recently been substantially expanded."

THE NATIONAL COAL BOARD'S annual report which, it is expected, will be published next month, is likely

*News in Brief*

to show that the accumulated deficit at the end of 1955 was about £37,000,000. This was revealed by Mr. Aubrey Jones, Minister of Fuel and Power, in Parliament recently. He added that the recovery of this deficit would depend on the trend of prices and productivity during the period for which new borrowing powers were being sought.

VISITING BIRMINGHAM, the Minister of Labour and National Service, opened the new training centre of the Birmingham and District Safety Group at Acock's Green, on April 12. Some £6,000 worth of equipment is installed in the new centre, which can deal with 30 trainees a week. A capital outlay of £7,000 is involved and an appeal among local industrialists has been launched to cover costs. It is expected that the Centre will be self supporting in two years time.

CONSEQUENT UPON the success of the Avoca (Co. Wicklow) copper mines the Mining Corporation of Ireland, Limited—a new mining company which has been formed in conjunction with the Canadian firm, Can-Erin Mines, Limited—will initiate drilling operations for copper deposits at Beauparc, Co. Meath, and for lead/zinc/silver deposits at Castle Blayney in the adjoining county, Monaghan, on May 1. This will be the first exploration for ore in this region since 1916.

A CONFERENCE, organized by the metallurgy (general) division of the British Iron and Steel Research Association, is to be held at Ashorne Hill, near Leamington Spa, on June 5 and 6, the chairman will be Mr. E. W. Colbeck, of Hadfields, Limited, and the vice-chairman, Mr. W. C. Heselwood, of United Steel Companies, Limited. Application forms and full details of the arrangements can be obtained from the organizer and secretary, Mr. J. R. Powell, of British Iron and Steel Research Association, 11, Park Lane, London, W.1.

DAVY & UNITED ENGINEERING COMPANY, LIMITED, Darnall, Sheffield, now have the record figure of £25,000,000 worth of orders on their books. The latest addition is a £7,000,000 contract for a rolling mill, a railway wheel and railway tyre- and axle-plant for the new integrated iron and steelworks which is being established by the Indian Government at Durgapur, West Bengal. The order is part of the £80,000,000 deal made by the Indian Steelworks Construction Company, Limited, with the Indian Government.

CONTROLLING INTEREST in the Patent Shaft & Axletree Company, Limited. whose capital has been sold by the Iron and Steel Holding Realization Agency for £900,000, has been acquired by Cammell Laird & Company, Limited, which has bought 75 per cent. of the capital. The other 25 per cent. has been bought by the former owners, the Metropolitan-Cammell Carriage & Wagon Company, Limited, which is jointly owned by Cammell Laird and Vickers, Limited. The compensation paid on nationalization was £892,500.

THE GOVERNOR-GENERAL of the Federation of Rhodesia and Nyasaland. Lord Llewellin, is to open the concentrator plant at Chibuluma, newest mine of the Rhodesian Selection Trust Group of Companies, on May 5. Chibuluma, nine miles west of Kitwe, will be the first new mine in the copperbelt of Northern Rhodesia to go into production since just before the outbreak of the second world war. Its estimated ore reserves are 7.3 million tons at an average grade of 5.23 per cent. copper and 0.25 per cent. cobalt. About 480,000 tons of ore will be hoisted annually to produce 16,000 tons of copper and 500,000 lb. of cobalt.

ARRANGEMENTS ARE BEING MADE by Colonel C. A. B. Lindop, chairman of H. & J. Hill (Willenhall), Limited, for a representative display of the firm's castings to be on show at the Victoria Hotel, Wolverhampton, on April 26, when the company's annual general meeting is held. In his report to shareholders, Col. Lindop reports an improvement of nearly 40 per cent. in the company's turnover last year and states that the order book is still very healthy, although keen competition is being faced. With a view to testing export markets, Mr. J. C. Lindop recently made an extensive tour of South Africa and Rhodesia.

ON APRIL 2, the A.E.I. Lamp & Lighting Company, Limited, Crown House, Aldwych, London, W.C.2, came into operation to market the lamp and lighting products of the British Thomson-Houston Company, Limited, Edison Swan Electric Company, Limited, and Metropolitan-Vickers Electrical Company, Limited. The brand names associated with the lamp and lighting products of the companies are being retained. The chairman of the new company is Mr. E. H. Ball, M.I.E.E., managing director of the British Thomson-Houston Company, Limited, and a director of Associated Electrical Industries; joint managing directors are Mr. V. C. H. Creer and Mr. S. R. Eade, M.I.E.E.

OWING TO THE FACT that lorry drivers delivering goods are greatly handicapped because many firms name only their works and do not provide the street name or postal district number, the transport committee of Sheffield Chamber of Commerce is seeking to get support throughout the country for the provision by firms of their full address for delivery purposes. The committee has asked all members of the Chamber to act on these recommendations:—(1) There should be closer co-operation between purchasing and transport sections when orders are placed, so that more detailed instructions for delivery are given on orders; and (2) Street addresses and postal districts should always be given, irrespective of the size of the buyers' premises.

AT A "Youth in Industry" conference in Birmingham on April 5, young employees in Midland industry met management representatives under the chairmanship of Mr. J. A. Hunt, and discussed the needs and problems of young people. The aim of the conference, arranged by the British Association for Commercial and Industrial Education, was to discover the thoughts of young people about their education in relation to their jobs, the work itself, the training given and the people they met in industry. The young delegates, selected from many Midland firms, including some foundries, thought desirable qualities in a good employer were: that he should get to know his workpeople; should show tolerance and understanding to apprentices; he should be firm, and have integrity.

MR. C. M. VIGNOLES, managing director of Shell-Mex & B.P., Limited, speaking at the Factory Equipment Exhibition at Earls Court, London, where the opening ceremony was performed on April 9 by the President of the Board of Trade, Mr. Peter Thorneycroft, appealed to the Government to assist oil-burner manufacturers to produce in time the special equipment needed, to make possible the great expansion called for in the industrial use of oil fuel. The use of oil on the scale necessary to enable the country to solve the fuel problem would throw an immense burden on the equipment manufacturers, he said. Their work might well be impeded by shortage of steel. Yet somehow they must obtain the necessary raw materials and machine tools, and train the required skilled labour to convert what had always been a craftsman's industry to quantity production.

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Photograph by courtesy of Vowles Aluminium Foundry Ltd West Bromwich

**THROUGHPUT**
*–up to 900 lb. per hour*

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*–only 4½ gallons per hour (MAX)*

**LOW METAL LOSS**
*0·6 %*

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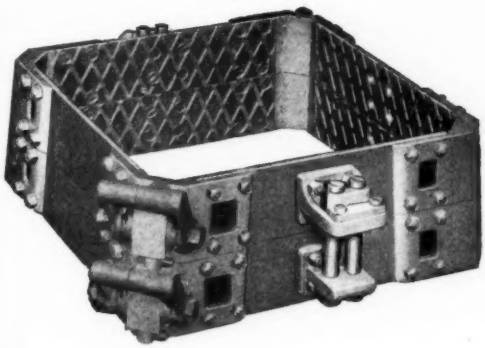

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## Personal

Brig. G. H. WALTON has been appointed a director of the Morgan Crucible Company, Limited.

AIR CHIEF MARSHAL SIR JOHN NELSON BOOTHMAN, K.C.B., K.B.E., joins the board of Kelvin & Hughes, Limited, as technical sales director on May 1.

Mr. H. J. TAYLOR has been appointed manager of the Hadyn Park works of Johnson Matthey & Company, Limited, in succession to Mr. A. GODDEN.

Geo. W. King, Limited, announce that MR. HARTFORD M. KING has been appointed to the board as sales director, this to be confirmed at the annual general meeting of the company.

Hepburn Conveyor Company, Limited, Wakefield, announce that Mr. C. ASHTON has been appointed joint managing director with Mr. C. NEWTON, who is also chairman of the company.

Mr. FRANK B. GEORGE, who is general works manager and has been with the Consett Iron Company, Limited, for many years, has been appointed general manager with a seat on the board.

MR. H. R. BIRKENSHAW, who joined the firm of Edgar Allen & Company, Limited, in 1917, has been appointed manager of the company's London office (3, St. James's Square, London, S.W.1).

Mr. GEORGE RANDSLEY, chief accountant of Herbert Morris, Limited, Loughborough, will be elected to the board of directors with effect from May 7. He has been associated with the firm since 1947.

A grandmother clock was given by the staff of the Stour Vale Ironworks, Kidderminster, to Mr. J. D. PARKES, assistant works manager, on his retirement after 51 years' service with the company.

MR. J. E. STEEL, chairman and managing director of Steel & Company, Limited, engineers, Pallion, Sunderland, has been appointed deputy chairman of the Peterlee Development Corporation, Co. Durham.

Dr. J. E. HURST, C.B.E., J.P., a past-president of the Institute of British Foundrymen, has had bestowed upon him by the Rector and Senate of the Karlsruhe Technical High School the degree of doctor of engineering (*honoris causa*).

Sir BERNARD KEEN and Mr. A. G. P. POWELL have been elected to the Board of Baird & Tatlock (London), Limited, and Mr. W. C. JOHNSON and Mr. H. N. RICKETTS have been elected to the board of Hopkin & Williams, Limited, another firm in the same group.

MR. B. W. PAYNE has been appointed director and general manager of Glow-Worm Boilers, Limited, Milford, nr. Derby. Mr. Payne was formerly manager for Carron Company and prior to that managing director of Smith & Wellstood, Limited. Mr. H. A. S. Moule, general sales manager, has been appointed to the board of directors.

United Steel Companies, Limited, announce that Mr. S. R. HOWES, director and general manager of Samuel Fox & Company, Limited, of Stocksbridge, is to retire on June 30. He will remain on the board of Samuel Fox & Company, Limited. Mr. Howes will be succeeded by Mr. H. P. FORDER, at present director and deputy general manager of the branch.

Mr. JOHN MASON, works manager of James Beresford & Son, Limited, of Kitts Green, Birmingham, completed 50 years' service with the firm on April 7. Mr. Mason recently took control of the railway and road transport fittings division, a branch with which he has been associated for almost the whole of his service with the firm. The directors have presented Mr. Mason with a radiogram.

Mr. W. J. SOMMERVILLE, London manager since 1930 of the Fraser & Chalmers Engineering Works of the General Electric Company, Limited, retired on March 31 after 36 years with the company. Mr. Sommerville, who was born in Glasgow and educated in Edinburgh, spent his early working life in British Columbia and on the Gold Coast. He joined the staff of Fraser & Chalmers at Erith in 1920, and for 10 years he represented their interests in India. Between 1939 and 1945, in addition to his responsibilities in London, he also managed the mining and general-engineering department at Erith.

VISCOUNT INGLEBY OF SNILESWORTH—formerly Mr. Osbert Peake, M.P. for North Leeds—and MR. G. D. LAVERS have joined the board of Hargreaves (Leeds), Limited. Viscount Ingleby is a brother of Mr. Harald Peake, the chairman of the company, who recently became chairman of the Steel Company of Wales, Limited. Mr. Lavers joined the group in 1945 and is now managing director of Hargreaves Motors, Limited, and a director of several other companies in the group. Mr. A. J. MARTIN, secretary of the company, has been appointed comptroller and secretary. He became secretary in 1950 and serves as financial director on the boards of companies in the Hargreaves group.

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## Obituary

The death occurred on April 3 of Dr. ALLAN BURNESS CLARK, who for the past 15 years had been medical officer of the David Brown group of companies.

Mr. W. M. FURNISS, who died on April 9 at the age of 86, was chairman and managing-director of the Electric Construction Company, Limited, of Bushbury, Wolverhampton, until his retirement in December, 1953.

The death has occurred of Mr. JAMES C. MCDOUGALL, a director of Hugh Smith & Company (Possil), Limited, hydraulic engineers, etc., of Glasgow. He joined the firm in 1935 as chief draughtsman and became a director in 1952. He was 45.

Mr. JOHN HOWARD BEACH, who died in February at the age of 81, was appointed chairman of the Gloucester Railway Carriage & Wagon Company, Limited, in June last year. He also took over the chairmanship of the subsidiary companies, which include Gloucester Foundry, Limited.

Mr. NORMAN CHARLES ROBERTSON, deputy managing director of E. K. Cole, Limited, electrical engineers, etc., of Southend-on-Sea, and a director of Ekco Electronics, Limited, has died at the age of 47. In 1951 Mr. Robertson accepted the then newly created position of Director-General of Electronics Production, Ministry of Supply, a position he held for two years.

The death is announced of Mr. PIERRE RICARD, who before he joined the French iron and steel employers' federation, was a leading spirit in the French foundry industry. He was amongst those who founded the *Centre Technique des Industries de la Fonderie*, and in its early days presided over its destinies. On numerous occasions, he was chief guest at foundry functions, being an orator of outstanding ability. Not only in France, but wherever castings are made his loss will be keenly felt.

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# Raw Material Markets

## Iron and Steel

At the beginning of this month a new blast furnace came into operation at West Hartlepool, raising the total number in operation to 103, but steelworks' needs remain so largely in excess of the output that one or more furnaces in Derbyshire are to be transferred to the manufacture of basic iron. This may not jeopardize the provision of high-phosphorus iron for the light foundries, as the makers have recently accumulated small surpluses, which have been sold for export. Makers of high-duty castings, however, are very busy and are taking up maximum tonnages of hematite and low- and medium-phosphorus irons.

Supplies of steel semis from the Continent are becoming very tight, German and Belgium exporters having little to offer. This position was not unforeseen. Re-rollers have fairly good supplies in hand to cover their immediate needs and only the smaller sizes of billets are really scarce, but for all classes of blooms, billets, and slabs the re-rolling industry is increasingly dependent upon a regular flow of material from British steelworks.

Impressive features of the finished steel trade are the relentless pressure of demand for constructional steel, and a reluctance on the part of the makers to accept further business if firm delivery dates are required. Producers have carried forward into the second period very substantial tonnages which have been on their books for many months and more business appears to be banking up.

The pressure for galvanized sheets has abated a little, but in spite of rising mill outputs, deliveries of plates, joists, and sections are far below requirements. Rail mills have heavy rolling programmes and there is a large unsatisfied demand confronting the wire mills.

## Non-ferrous Metals

The centre of interest has inevitably been the Budget and in the preceding days there was little interest displayed on the market with the possibility of big developments round the corner, as it were. Consequently the gentle downward curve of prices over the weekend and the beginning of this week does not imply an inherent weakness in the market. Admittedly, there has not been a great deal of business and supply and demand would seem to be in better balance, but in the next day or so it may be possible to discern the first effects of Mr. Macmillan's proposals and a clearer picture of the trend in this country is expected to appear in the next few weeks.

It is apparent that copper consumption has fallen off somewhat this year in the United Kingdom, but there may be some compensation for the decline in the offtake of metal for the motor industry in the announcement of further plans for the modernization of British Railways under the 1956-57 programme. More problematic is whether further export orders will stem from the credit squeeze which has been affecting home markets. Stocks of refined copper in London Metal Exchange warehouses at the end of last week, at 4,289 tons, showed an increase of 114 tons over the previous week.

Tin has been no exception as far as the dullness of the market is concerned. In the United States the quietness may be judged by the fact that the probable continuance of the working of the Texas tin smelter until next year at least seems to be the strongest influence on the market still. Tin stocks in LME warehouses at the end of last week showed a decline, at 958 tons, compared with 1,150 tons at the end of the previous week.

Lead continues on its uneventful way. In London prices tend to slip and the market looks as though it might sag a little. The US market is holding fairly firm with the support of the domestic stockpile behind it. Demand for zinc on this side is rather slack and supplies of the higher grades are meeting requirements.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* April 12, £377 to £377 10s.; April 13, £380 to £380 10s.; April 16, £377 10s. to £378; April 17, £372 to £374; April 18, £365 10s. to £366.

*Three Months:* April 12, £371 to £371 10s.; April 13, £374 10s. to £375; April 16, £371 10s. to £372; April 17, £367 to £368; April 18, £359 10s. to £360.

TIN, Standard—*Cash:* April 12, £766 to £767; April 13, £768 to £770; April 16, £767 to £768; April 17, £763 to £764; April 18, £760 10s. to £761 10s.

*Three Months:* April 12, £760 to £761; April 13, £761 to £762; April 16, £760 to £761; April 17, £759 to £760; April 18, £757 to £758.

LEAD—*First half April:* April 12, £117 15s. to £118; April 13, £117 5s. to £117 10s. *Second half April:* April 16, £116 5s. to £116 10s.; April 17, £114 to £114 10s.; April 18, £112 10s. to £113.

*First half July:* April 12, £116 15s. to £117; April 13, £116 15s. to £117. *Second half July:* April 16, £115 15s. to £116; April 17, £113 15s. to £114; April 18, £112 10s. to £113.

ZINC—*First half April:* April 12, £98 15s. to £99; April 13, £98 12s. 6d. to £98 15s. *Second half April:* April 16, £98 15s. to £99; April 17, £98 to £98 10s.; April 18, £97 to £97 5s.

*First half July:* April 12, £97 5s. to £97 10s.; April 13, £97 10s. to £97 12s. 6d. *Second half July:* April 16, £97 10s. to £97 15s.; April 17, £97 to £97 5s.; April 18, £95 15s. to £96.

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### Coloured Refrigerators

The Pressed Steel Company, Limited, at a reception held in London recently, well justified a decision to provide a number of optional colour-combinations for their new 3.6 cub. ft. refrigerator. It was reported that no clear-cut indication of definite colour preference had been given in response to questionaires sent earlier to large groups of persons representing many different professions—psychiatrists, doctors, oculists, architects, journalists, housewives, etc. By providing detachable base-portions and vitreous-enamelled, table-type tops in six different colours to assemble with white or cream cabinets, it is claimed that 48 colour schemes are possible for the new model. Moreover, new tops or base-pieces can be purchased separately if a change in colour scheme is desired.

### Scrap from Refuse Dumps

At the annual luncheon in Birmingham last month of the Midland Scrap Iron, Steel and Metals Association, Mr. C. Roberts, president of the National Federation of Scrap Iron, Steel and Metal Merchants, suggested that local authorities should be directed to salvage the metal in their refuse. The Government, he said, should not permit the "indiscriminate depositing of rubbish and tins up and down the country." There was a great waste of material involved. Capt. H. Leighton Davies, chairman of the Scrap Committee of the British Iron and Steel Federation, said that of the 500,000 tons of tinplate sold annually, mostly to be made into tin cans, only about 12,000 tons were being recovered.